Joint Publication 3-11

Operations in Chemical, Biological, Radiological, and Nuclear Environments

29 September 2024

PREFACE

1. Scope

This publication provides doctrine to plan, execute, and assess military operations in chemical, biological, radiological, and nuclear environments.

2. Purpose

This publication has been prepared under the direction of the Chairman of the Joint Chiefs of Staff (CJCS). It sets forth joint doctrine to govern the activities and performance of the Armed Forces of the United States in joint operations, and it provides considerations for military interaction with governmental and nongovernmental agencies, multinational forces, and other interorganizational partners. It provides military guidance for the exercise of authority by combatant commanders and other joint force commanders (JFCs), and prescribes joint doctrine for operations and training. It provides military guidance for use by the Armed Forces in preparing and executing their plans and orders. It is not the intent of this publication to restrict the authority of the JFC from organizing the force and executing the mission in a manner the JFC deems most appropriate to ensure unity of effort in the accomplishment of objectives.

3. Application

a. Joint doctrine established in this publication applies to the Joint Staff, combatant commands, subordinate unified commands, joint task forces, subordinate components of these commands, the Services, the National Guard Bureau, and combat support agencies.

b. This doctrine constitutes official advice concerning the enclosed subject matter; however, the judgment of the commander is paramount in all situations.

c. If conflicts arise between the contents of this publication and the contents of Service publications, this publication takes precedence unless the CJCS, normally in coordination with the other members of the Joint Chiefs of Staff, has provided more current and specific guidance, or the Secretary of Defense has directed otherwise. Commanders of forces operating as part of a multinational (alliance or coalition) military command should follow multinational doctrine and procedures ratified by the United States unless they conflict with this guidance. For doctrine and procedures not ratified by the United States, commanders should evaluate and follow the multinational command's doctrine and procedures, where applicable and consistent with United States law, regulations, and doctrine.

For the Chairman of the Joint Chiefs of Staff:

DAGVIN R.M. ANDERSON
Lieutenant General, U.S. Air Force
Director for Joint Force Development

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SUMMARY OF CHANGES
REVISION OF JOINT PUBLICATION 3-11
DATED 29 OCTOBER 2018

- **Incorporates content to reflect national policy and strategy changes related to chemical, biological, radiological, or nuclear (CBRN) defense.**

- **Reorganizes Chapter II, "Planning," and adds a specific section on protection considerations.**

- **Updates the discussion of CBRN use impact on the execution of joint functions.**

- **Synchronizes content with Joint Publication 3-41, *Chemical, Biological, Radiological, and Nuclear Response.***

- **Improves alignment of United States military and North American Treaty Organization CBRN standards and terminology.**

- **Provides additional information on the chemical, biological, radiological, and nuclear warning and reporting system.**

- **Adds new Chapter V, "Operations in Chemical, Biological, Radiological, and Nuclear Environments of the Future."**

- **Revises the classified appendix on nontraditional agents.**

- **Modifies, adds, and removes terms and definitions from the *DoD Dictionary of Military and Associated Terms.***

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EXECUTIVE SUMMARY
COMMANDER'S OVERVIEW

- **Introduces chemical, biological, radiological, or nuclear (CBRN) defense capabilities available to the joint force commander to reduce the vulnerability of the force, mitigate the effects of CBRN incidents, and improve response to and recovery from CBRN incidents.**

- **Provides an overview of strategic and operational CBRN planning.**

- **Discusses the importance of hazard awareness and understanding and situational awareness during the execution of operations in a CBRN environment.**

- **Discusses unique aspects of the CBRN environment that affect the assessment process.**

Fundamentals

General

A chemical, biological, radiological, or nuclear (CBRN) incident is the emergence of CBRN hazards resulting from the use of CBRN weapons or devices; the emergence of secondary hazards due to counterforce targeting or other friendly force action; or any other event that causes the release of toxic industrial material into the operational environment (OE).

CBRN hazards are materials that could create adverse effects if released. They include toxic industrial materials (including toxic industrial chemicals, toxic industrial biologicals, and toxic industrial radiologicals), chemical and biological agents, biological pathogens, pharmaceutical-based agents, and nontraditional agents. They also include hazards resulting from the employment of weapons of mass destruction (WMD).

CBRN defense capabilities counter the entire range of CBRN hazards. CBRN defense reduces the vulnerability of the force, mitigates the effects of CBRN incidents, improves response to and recovery from CBRN incidents, and maintains the joint force's ability to continue military operations in a CBRN environment.

National Strategy

The Department of Defense (DoD) strategy outlines countering weapons of mass destruction (CWMD)-

specific priorities tailored to current and emerging WMD challenges. It also reinforces, complements, and integrates other national guidance by clarifying the role of the CWMD mission within the DoD's overall approach to integrated deterrence and conflict.

Strategic Context

The worldwide availability of advanced military and commercial technologies and information (including dual-use facilities and technologies, and emerging nontraditional threats), combined with commonly available transportation and delivery means, may allow adversaries opportunities to acquire, develop, and employ WMD or create a CBRN environment without regard for national or regional boundaries.

Operational Context

Operating in a CBRN environment can impact freedom of movement and the preservation of combat power. Because of the potentially devastating consequences of CBRN hazards from intentional or unintentional release, measures are planned, prepared, executed, and assessed to enable forces to continue effective operations in a CBRN environment, as well as protect them and mitigate the effects of CBRN hazards on military and nonmilitary personnel, equipment, and infrastructure.

Relation to the Joint Functions

Joint functions refer to related capabilities and activities organized into seven groups: command and control; information; intelligence; fires; movement and maneuver; protection; and sustainment. These help joint force commanders (JFCs) synchronize, integrate, and direct joint operations. Each of these joint functions may be affected when conducting operations in an area where CBRN threats or hazards are present.

Planning

General

United States (US) forces should be prepared to conduct prompt, sustained, and decisive military operations in CBRN environments. Regardless of how material was released, a CBRN incident can create effects that disrupt or degrade operations to achieve US and multinational objectives.

Overview of Strategic and Operational Chemical,

Strategic-Level Planning. Factors that impact the combatant command's strategic-level CBRN planning include treaties; international law, customs, and practices; DoD policies; existing

Biological, Radiological, and Nuclear Planning

agreements/arrangements with host nations en route to and within the operational area; and the use of propaganda to influence US public and world opinion. Political factors, sociocultural factors, and economic characteristics of the OE assume increased importance for deterrence at the strategic level. These factors may, in fact, have an overriding influence on any courses of action (COAs) involving WMD.

Operational-Level Planning. The use of threat assessments, capability assessments, and vulnerability assessments during the development of operational-level plans provides the commander and staff with shared understanding of the effects that may be created by CBRN incidents within the OE.

Understanding the Effects of Chemical, Biological, Radiological, and Nuclear Employment on the Operational Environment

The joint intelligence preparation of the operational environment (JIPOE) process analyzes the OE to identify possible adversary COAs related to the proliferation or employment of CBRN weapons or materials. Tailored JIPOE products assess the potential for accidental or deliberate release of CBRN materials within the operational area. Other products characterize the consequences of CBRN-related incidents and support the joint force's CBRN defense efforts.

Chemical, Biological, Radiological, and Nuclear Hazard Awareness and Understanding

CBRN hazard awareness is the ability to use intelligence about CBRN threat dispositions and intentions and to determine the characteristics and parameters of CBRN hazards throughout the OE that impact decision making and consequently, CBRN defense activities. CBRN hazard understanding is the ability to individually and collectively comprehend the implications of the character, nature, or subtleties of information about CBRN hazards and their impact on the OE, mission, and force, to enable situational understanding.

Assessments and Risk Management

Threat Assessment. The CBRN threat assessment helps commanders make better-informed decisions about which protective measures to adopt. It helps identify the most likely CBRN threats and hazards that units and personnel may face and allows units to identify the protective and vulnerability reduction measures most likely to keep them safe.

Friendly Capability Assessment. In addition to continuously assessing the adversary CBRN capability, commanders also continuously conduct friendly force capability assessments from initial planning through all phases of the operation, as they assess how to best employ forces and equipment in a CBRN environment. This capability assessment is a comparison of the proficiency and resources required to support the commander against current unit capabilities for protection and CBRN defense, including the proficiency of individual CBRN staff officers, command posts, cells, and elements.

Risk Management. The JFC weighs effective CBRN passive defense against two risks: the logistical cost to achieving mission objectives; and the cost of recovering force capabilities if an attack occurs without passive defense measures. Use of risk assessment and management tools enables the JFC to effectively execute a risk mitigation plan during operations in a CBRN environment.

Operational Challenges of Chemical, Biological, Radiological, and Nuclear Environments

Deterring Adversary Employment. A fundamental premise of US military planning is that adversaries are most likely to be deterred from provocative action when US forces are sufficiently and visibly organized, trained, and equipped to defeat the provocation and create a credible response.

Reducing Vulnerability to Adversary CBRN Capabilities. Vulnerabilities should be examined through continuous comprehensive assessments and integrated with risk management decisions that encompass the full range of potential targets subject to CBRN attack.

Preventing Adversary CBRN Weapons Employment. JFCs should also make every effort within their authority to prevent the adversary from successfully acquiring and delivering CBRN weapons, using the full extent of actions allowed by the rules of engagement and rules for the use of force, as applicable.

Conducting Multinational Operations. When conducting combat operations, the JFC should consider the capabilities and limitations of all available forces to maximize their contributions and minimize their vulnerabilities. Peacetime activities with multinational partners, particularly multinational and interagency training and planning exercises, provide means of preparing for multinational combat operations in CBRN environments.

Synchronization of Operations. Successful synchronization in CBRN environments includes the proper integration of, and sequencing among, intelligence collection capabilities, active and passive defense measures, offensive activities, CBRN response, and sustainment.

Integrated Early Warning (IEW). IEW for CBRN threats and hazards includes material and nonmaterial capabilities that provide awareness and understanding of threats and hazards to support a commander's ability to make decisions.

CBRN Warning and Reporting. The chemical, biological, radiological, and nuclear warning and reporting system (CBRNWRS) provides a common system for initial reporting, creating hazard predictions, and reporting updated information on CBRN incidents. Standardized report content items, report templates, and prediction methods are used by joint and allied forces.

CBRN Facilities. Planners should consider the risk of conflict near or directed at CBRN facilities or their occupation by adversary forces as part of threat assessments and prevention and mitigation measures as appropriate.

Commanders and their staffs develop plans and implement actions to counter adversary actions during peacetime and early in crises. These plans and activities require joint, multinational, and interagency coordination for activities that support CBRN awareness and understanding, protection of critical assets, and contamination mitigation measures.

Protection Planning

Planning Force Protection. Protecting the force consists of those actions taken to conserve the force by identifying CBRN threats and hazards and preventing or mitigating the effects of operating in CBRN environments.

Force Health Protection. Medical protection of the force against CBRN threats involves integrated preventive, surveillance, and clinical programs.

Biosurveillance. Biosurveillance is the process of gathering, integrating, interpreting, and communicating essential information related to threats or disease activity affecting human, animal, or plant health.

Protective Equipment. Sufficient equipment should be available to protect the uniformed force and mission-essential personnel.

Emergency Management and CBRN Response Measures. Joint installation commanders manage and maintain comprehensive, all-hazards installation emergency management programs on DoD installations worldwide. The DoD Chemical, Biological, Radiological, and Nuclear Enterprise supports and assists civil authorities in emergency management activities to mitigate, prevent, protect, respond to, and recover from natural or man-made CBRN incidents.

Preparation Considerations

During preparation, the focus is on deterring and preventing adversaries from taking actions that affect combat power. Since the joint force is most often vulnerable to surprise and attack during preparation, the implementation of hazard awareness and understanding activities, protection of critical assets, and contamination mitigation measures with ongoing preparation activities assists in the prevention of negative effects.

Other Planning Considerations

Focused JFC staff planning related to conducting operations in CBRN environments includes:

- Establish cooperative policies, procedures, and networks to integrate CBRN defense for the joint force, other interagency members, host nation, and multinational partners to operate in a CBRN environment.
- Recognize the most likely CBRN threats and hazards from updated adversary tactics, capabilities, intentions, and the environment.
- Conduct assessments (threat, vulnerability, previous incident/past use, impact,

meteorologic/oceanographic, hazard prediction modeling).

- Provide recommendations for the critical asset list and defended asset list.
- Coordinate unit protection measures, especially individual protective equipment, troop safety criteria, operational exposure guidance, automatic masking criteria, bypass criteria, collective protection equipment, and decontamination equipment and procedures.
- Establish the appropriate recovery and mitigation actions to match the threat, hazards, and locations.
- Coordinate logistics activities, personnel services support, health services (including vaccinations, medical countermeasures, and veterinary services if applicable), and reconstitution efforts.
- Coordinate CBRN health surveillance activities (including biosurveillance and the distribution of prophylaxis) through the applicable command surgeon channel.
- Synchronize the policies, people, and processes for expedited collection, transport, and analysis of medical specimens, food, water, and environmental samples from CBRN incidents.
- Provide commanders' guidance for forces and facilities to ensure they are prepared to operate in CBRN environments.
- Establish procedures for processing, decontaminating, and disposing of contaminated equipment and clothing.
- Establish procedures for processing and repatriating contaminated human remains.
- Establish a communication plan with redundancy to include primary, alternate, contingency, and emergency means of communication.

Sustainment Considerations

For operations in a CBRN environment, unique sustainment considerations should include:

- Procuring, storing, and managing an appropriate amount of individual protective equipment/ personal protective equipment, decontaminants, consumables, and other CBRN defense supplies to outfit all units arriving into the area of operations for the purpose of conducting personnel and equipment protection and sustained decontamination operations.

- Coordinating the resupply of CBRN defense and monitoring equipment. CBRN-related equipment is often commercial off-the-shelf and may need special consideration for maintenance and replacement.
- Conducting contamination mitigation.

Execution

General

Along with unity of command, centralized planning and direction and decentralized execution are key considerations in how JFCs organize and employ their forces. While JFCs may elect to centralize some functions, they should avoid reducing the versatility, responsiveness, and initiative of subordinate forces. JFCs should allow Service component and special operations forces organizations and capabilities to function generally as they were designed.

Hazard Awareness and Understanding and Situational Awareness

CBRN Hazard Understanding. CBRN hazard understanding is the dynamic collective comprehension of the implications of emerging CBRN environments within the OE, facilitating the framing of problems and decision making during execution.

The CBRNWRS plays an instrumental role in achieving situational understanding. Awareness of a CBRN hazard results in warnings, alerts, and reports that provide hazard data, which is key to decentralized operational decisions at all levels within the joint force.

Protection

The use of WMD, or presence of CBRN hazards, in a joint force's operational area requires specific actions to safeguard both the force and mission. Throughout the operation or campaign, the JFC employs active defense measures, such as air and missile defense and physical security, to defend against conventionally and asymmetrically delivered WMD.

Contamination Mitigation

As part of execution, contamination mitigation enables joint forces to sustain operations in a contaminated environment without prolonged interruption of operating tempo.

Sustainment Considerations

Operations slow as personnel encumbered by protective equipment or exposed to CBRN environments perform tasks. This may require abandonment or limited use of contaminated areas, transfer of missions to uncontaminated forces, or avoidance of contaminated terrain and routes. Additionally, the use of WMD or other CBRN incidents resulting in a major disruption of normal personnel and materiel replacement processes in the theater could severely hamper the commanders' capabilities for force generation and sustainment.

Operation Assessment

General

Assessment of operations conducted in CBRN environments increases the quantity and nature of variables that are considered and analyzed to provide commanders with the most viable COAs. Planning and preparing for the assessment process begins with the initial stage of joint planning, and during mission analysis the initial set of mission success criteria normally becomes the basis for assessment.

Operation Assessment Process

The staff should monitor and evaluate the following aspects of the CBRN environment as part of the assessment process:

- Changes to CBRN threats and hazards.
- Changes in force vulnerabilities to CBRN hazards.
- Changes to unit capabilities.
- Validity of assumptions as they pertain to CBRN defense.
- Staff and commander estimates.
- CBRN resource allocations.
- Increased risks.
- Supporting efforts.

CONCLUSION

This publication provides doctrine to plan, execute, and assess military operations in CBRN environments.

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CHAPTER I
FUNDAMENTALS

> *"Today we face unprecedented WMD [weapons of mass destruction] threats. China, Russia, Iran, North Korea, and violent extremist organizations continue to quietly develop their WMD capabilities to acquire asymmetric and non-traditional means to gain a decisive advantage against the United States and our allies and partners. In particular, chemical and biological threats are expanding at an exponentially accelerated pace due to the convergence of multiple sciences and rapid technological developments."*
>
> **Dr. Brandi C. Vann**
> **Acting Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs Testimony for the House Committee on Armed Services, Intelligence and Special Operations Subcommittee**
> **May 4, 2021**

1. General

a. Hostile state and non-state actors who possess or are seeking to acquire weapons of mass destruction (WMD) pose a threat to the United States and its allies. The intent, capability, or actual employment of chemical, biological, radiological, or nuclear (CBRN) materials, including toxic industrial materials (TIMs) and nontraditional agents (NTAs), can seriously challenge United States (US) military operations. Further, the loss of control or theft of CBRN materials, TIMs, NTAs, and other WMD in theater constitutes a significant threat to the joint force, as can accidents at, and collateral damage to, industrial facilities and naturally occurring phenomena such as pandemic influenza and infectious diseases. The deadly, destructive, and disruptive effects of these weapons, materials, and phenomena merit continuous consideration by the joint force commander (JFC) and supporting commanders. The threat to the joint force is compounded by our adversaries' relative freedom of access to chemical agent pre-cursors, biological weapons seed stock, technical equipment, and global information sources, making hazardous material and information for transforming it into a weapon much more accessible. The joint force is increasing CBRN defense and response capabilities and readiness standards to enhance its survivability in the face of a CBRN hazard and enable it to conduct uninterrupted operations.

b. This publication focuses on maintaining the joint force's ability to conduct operations in a CBRN environment. It describes the CBRN environment in a strategic context, provides strategic and operational considerations, and describes CBRN defense activities and tasks applicable to joint operations. The strategic environment consists of a variety of national, international, and global factors that affect the decisions of senior civilian and military leaders with respect to the employment of US instruments of national power. Although the basic nature of war has not changed, the character of war has evolved. The operational environment (OE) and the threats it presents are increasingly transregional, multi-domain, and multifunctional. The crises and contingencies joint forces face today involve multiple combatant commands (CCMDs); all domains, the information environment; the electromagnetic spectrum; and conventional and unconventional capabilities. The OE is influenced by the strategic environment. Decision making is informed by the *Department of Defense Strategy for Countering Weapons of Mass Destruction* and works in concert with Joint Publication (JP) 3-40, *Joint Countering Weapons of Mass Destruction*, and JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response*.

c. The CBRN environment includes CBRN threats and hazards and their potential effects on operations. These effects can be created through the intentional or unintentional release of CBRN materials in the OE. Intentional release includes deliberate employment by an adversary or collateral effects from conventional attacks. Unintentional release includes man-made accidents or naturally occurring incidents. Operations in CBRN environments require specific procedures to minimize or negate CBRN threats and hazards. Such operations may require the employment of strategic and operational capabilities. Compared to domestic CBRN operations, those occurring in foreign countries pose further challenges, such as operating under different laws and authorities, and partners using different doctrine. Adversary information activities may seek to enhance the impact of CBRN incidents by spreading misinformation or panic, especially in an urban environment. For operations in a CBRN environment in the homeland, see JP 3-27, *Homeland Defense;* JP 3-28, *Defense Support of Civil Authorities;* and JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response.*

(1) A CBRN incident is the emergence of CBRN hazards resulting from the use of CBRN weapons or devices; the emergence of secondary hazards due to counterforce targeting or other friendly force action; or any other event that causes the release of TIM into the OE. Because of the broad definition, a hazard may first be described as a CBRN incident until it is determined to be an attack. The term CBRN incident can be used to describe natural or man-made release of various agents or exposures to biological hazards, including those endemic in the operating environment.

(2) CBRN hazards are materials that could create adverse effects if released. They include TIMs (including toxic industrial chemicals [TICs], toxic industrial biologicals [TIBs], and toxic industrial radiologicals), chemical and biological agents, biological pathogens, pharmaceutical-based agents, and NTAs. They also include those hazards resulting from the employment of WMD.

(a) Chemical hazards include any toxic chemical. This includes chemical agents and chemicals developed or manufactured for use in industrial operations (e.g., phosgene), agricultural (e.g., glyphosate), medicine (e.g., pharmaceutical-based agents), or research that pose a hazard, which can be collectively characterized as TIC.

(b) Biological hazards include any organism, or substance derived from an organism, that poses a threat to the health of any living thing. Biological hazards may be biological weapons; naturally occurring endemic, and zoonotic diseases, or natural emerging or reemerging disease outbreaks. They are a threat to military operations and may also degrade the joint force's readiness. Biological material that is manufactured, used, transported, or stored by industrial, agricultural, medical, or commercial processes, and could pose an infectious or toxic threat, are collectively characterized as TIB.

(c) Radiological hazards include ionizing radiation that can cause injury, or death from either external irradiation or radiation from radioactive materials within the body. Radiological material that is manufactured, used, transported, or stored by industrial, agricultural, medical, or commercial processes is collectively characterized as toxic industrial radiological.

(d) Nuclear hazards are those dangers associated with the overpressure, thermal, and radiation effects from a nuclear explosion. Nuclear hazards come from the employment of nuclear weapons and devices that can generate radiation; low-altitude, nuclear air-burst shock waves; severe winds; electromagnetic pulse (EMP) that can damage or destroy electronic, electrical, and electromagnetic spectrum-dependent devices that are not appropriately hardened; intense heat that can cause casualties and damage through burning, crushing, bending, tumbling, breaking, penetrating debris; and residual radiation in the form of fallout.

(e) Each of the CBRN hazards are further described in the supporting appendices.

(3) CBRN defense capabilities counter the entire range of CBRN hazards. CBRN defense reduces the vulnerability of the force, mitigates the effects of CBRN incidents, improves response to and recovery from CBRN incidents, and maintains the joint force’s ability to continue military operations in a CBRN environment.

2. National Strategy

a. Strategic guidance accounts for the primary threats to the United States, its allies, and partners. In addition to nation-state threats, nuclear terrorism continues to pose a threat as non-state actors remain interested in using WMD attacks against US interests and the US homeland. Dual-use knowledge, goods, and technology applicable to WMD continue to proliferate globally. Keeping nuclear materials from terrorists and preventing the development, proliferation, and use of WMD remains a high priority in securing US strategic objectives.

b. The Department of Defense (DoD) strategy outlines countering weapons of mass destruction (CWMD)-specific priorities tailored to current and emerging WMD challenges. It also reinforces, complements, and integrates other national guidance by clarifying the role of the CWMD mission within the DoD’s overall approach to integrated deterrence and conflict. Specific guidance includes deterring WMD attacks, defending the homeland from WMD attack, prevailing in a CBRN environment, and preventing new WMD threats.

c. Where proliferation or indigenous CBRN weapon development (including WMD) has occurred, the primary US national objective is to deter an enemy’s employment of CBRN weapons. To support deterrence, US forces are prepared to fight and win in CBRN environments. If deterrence fails, US forces may be called on to conduct operations to mitigate the effects of a WMD attack or other CBRN incidents. Success in these activities depends on accurate and complete CBRN risk assessments and mitigations, to include assessments that address adversary capabilities that may be used against US forces. Security cooperation activities can help shape the OE to dissuade or deter WMD or CBRN use.

For more information on security cooperation activities, see JP 3-20, Security Cooperation.

d. Additional strategic guidance is included in the *National Biodefense Strategy and Implementation Plan on Countering Biological Threats, Enhancing Pandemic Preparedness, and Achieving Global Health Security,* which provides a whole-of-government framework that organizes how the United States Government (USG) manages its activities to more effectively assess, prevent, prepare for, respond to, and recover from biological threats.

3. Strategic Context

a. A variety of crises and conflicts challenge US interests. They include competition between nation-states as well as international and non-state armed conflicts. Other crises could arise from epidemic disease outbreaks such as the Ebola virus or pandemic disease outbreaks such as COVID-19 [coronavirus disease-2019] that exceed the capabilities of a host nation (HN). These situations may threaten regional and global stability and may involve the territory and populations of the United States, its allies, multinational partners, other friendly countries, and a range of other US interests.

b. The worldwide availability of advanced military and commercial technologies and information (including dual-use facilities and technologies, and emerging nontraditional threats), combined with commonly available transportation and delivery means, may allow adversaries opportunities to acquire, develop, and employ WMD or create a CBRN environment without regard for national or regional boundaries. Such situations could expose a joint force to CBRN hazards and negatively impact force protection (FP), power projection, alliance preservation, prevention of adversary gains, and risks to US interests.

c. When their core interest or power bases are threatened, nation-states may choose to disregard international protocols, agreements, and treaties. In some cases, nation-states may be willing to acquire WMD or CBRN material, despite being signatories or parties to international agreements and treaties forbidding such actions. And some nation-states are overtly challenging and contesting international norms, international law, and the international order. Transnational terrorists do not consider themselves bound by such agreements and treaties. A continuously evolving, asymmetric threat presents a variety of operational options for disrupting US forces by threatening attack using CBRN capabilities. In an effort to circumvent defensive capabilities, several adversaries have the potential to use the expanding knowledge of chemical warfare and biological warfare or the global proliferation of relatively low-cost advanced technologies to develop new CBRN capabilities. US and friendly forces could be exposed to CBRN hazards anywhere in the operational area and at any phase of conflict, even during peacekeeping or joint stabilization activities. Friendly force exposure to CBRN effects could occur from an attack with WMD or from releases of CBRN elements due to accident or from attacks on infrastructure, including urbanized industrial areas. DoD continually develops new CBRN defense capabilities to address the complexities of the strategic context in which US forces perform missions in CBRN environments.

4. Operational Context

a. The combatant commanders (CCDRs) support USG efforts to cooperate with and support partners as part of CWMD activities. However, this cooperation and support does not necessarily guarantee a capacity for friendly forces to operate in a CBRN environment. With the exception of a number of allies, many of whom are charter members of the North Atlantic Treaty Organization (NATO), most of our multinational partners have limited capability to operate in a CBRN environment. While adversaries in most operational areas may not possess WMD or other CBRN materials, CBRN environments could result from other forms of CBRN hazards, if released. US forces must be trained and fully capable of operating in CBRN environments to accomplish all assigned missions.

b. Even if an adversary does not intend to employ WMD or use CBRN material to create a hazardous environment, the existence of CBRN threats and hazards in any operational area creates potential risks. In addition to accurate and timely intelligence of the CBRN threats, the existence of CBRN hazards in the form of TIMs or infectious diseases should also be considered in each OE. CBRN hazards may be used for antiaccess and area denial activities against US installations and facilities, ports of embarkation and debarkation, and the lines of communication between the United States and its forces deployed to an HN. Finally, a third party may use CBRN weapons on behalf of, or supply CBRN weapons to, an adversary.

c. Military support to emergency preparedness consists of active measures taken prior to an incident to reduce the loss of life and property and to protect a nation’s institutions from all types of hazards. JFCs support emergency preparedness in a CBRN environment through development of a response plan, participation in joint and multinational exercises, and training of HN personnel and units on CBRN tasks. When suitable, CBRN forces are partnered with like HN capabilities to maximize the value of their specific expertise, to familiarize all forces with the capabilities and strengths of their counterparts, and to assist in preparing for an incident.

d. Clearly established supporting and supported command relationships provide clarity of military authorities and facilitate effective interaction with interagency partners. These clearly established relationships are required to reduce vulnerability and minimize the effects of CBRN threats employed against key allied, HN, and US forces, installations, and facilities.

e. Operating in a CBRN environment can impact freedom of movement and the preservation of combat power. Because of the potentially devastating consequences of

CBRN hazards from intentional or unintentional release, measures are planned, prepared, executed, and assessed to enable forces to continue effective operations in a CBRN environment, as well as protect them and mitigate the effects of CBRN hazards on military and nonmilitary personnel, equipment, and infrastructure.

5. Relation to the Joint Functions

Joint functions refer to related capabilities and activities organized into seven groups: command and control (C2); information; intelligence; fires; movement and maneuver; protection; and sustainment. These help JFCs synchronize, integrate, and direct joint operations. Each of these joint functions may be affected when conducting operations in an area where CBRN threats or hazards are present.

For more information on the joint functions, see JP 3-0, Joint Campaigns and Operations.

a. **C2.** C2 encompasses the exercise of authority and direction by a commander over assigned and attached forces to accomplish the mission. It includes those tasks and systems associated with understanding friendly CBRN defense capabilities and information systems, managing relevant information, and directing and leading subordinates in CBRN environments. The joint force requires CBRN staff organizations and units that can characterize CBRN hazards; develop a clear understanding of current and anticipated CBRN situations; and collect, assimilate, and disseminate information from intelligence, health, and specific CBRN reconnaissance and surveillance sources in near real time. The CBRN staff assesses and provides predictions, warnings, and reports on potential effects of CBRN threats and hazards. This information helps the JFC identify critical CBRN-related objectives. It also helps the JFC visualize the sequence of events in a course of action (COA) that moves the force from its current state to the desired state. Operations in these environments require the integration of the chemical, biological, radiological, and nuclear warning and reporting system (CBRNWRS) with applicable homeland defense and emergency management systems to provide real-time warning and specific directions for action in domestic situations.

For additional information on the C2 function, see Army Techniques Publication (ATP) 3-11.36/Marine Corps Reference Publication (MCRP) 10-10E.1/Navy Tactics, Techniques, and Procedures (NTTP) 3-11.34/Air Force Tactics, Techniques, and Procedures (AFTTP) 3-20.70, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Planning.

b. **Information.** The joint force leverages information to affect the perceptions, attitudes, decision making, and behavior of adversaries who contemplate the use of CBRN materials. The information function provides JFCs the ability to leverage the informational aspects of military activities to achieve the commander’s objectives. Operations in the information environment can help shape the OE, deter adversaries from acquiring and using WMD, assure allies, maintain civil order, and bolster joint force morale. The requirement for protecting information systems and resources, particularly the CBRNWRS linkages to other USG authorities, remains a key component in operating in a degraded mode while in a CBRN environment.

See JP 3-04, Information in Joint Operations, *for more details.*

c. **Intelligence.** The JFC's CBRN staff collaborates with the intelligence staff to establish CBRN-related intelligence requirements and support the identification of CBRN threats and hazards. The commander's priority intelligence requirements should address the **adversary's ability to use CBRN weapons.** Intelligence (to include environmental and physical factors and their potential effects) provides the JFC and staff necessary details, such as enemy intentions, capabilities, types of agents, cover and deception methods, sensors, protective posture, and line-of-sight influences on direct fire, as well as friendly vulnerabilities to enemy strengths. Information subsequently collected using CBRN reconnaissance and surveillance assets is used to validate and supplement previously acquired intelligence within the joint intelligence preparation of the operational environment (JIPOE) process. The use of joint force intelligence assets during CBRN response operations in domestic environments for non-intelligence purposes is called incident awareness and assessment. Shared situational awareness among interagency partners and federal, state, and local responders results from incident awareness and assessment and is the keystone of timely, coordinated, and effective CBRN response. Any use of joint force intelligence assets in support of CBRN response operations, whether for intelligence purposes or incident awareness and assessment is in accordance with DoD policy.

For additional information on JIPOE and intelligence, see Chapter II, "Planning."

See Department of Defense Directive (DoDD) 5240.01, DoD Intelligence Activities; *DoDD 3025.18,* Defense Support of Civil Authorities (DSCA); *Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3125.01,* Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland; *and JP 3-28,* Defense Support of Civil Authorities, *for guidance on incident awareness and assessment.*

d. **Fires.** When targeting CBRN threats, fires are intended to destroy the CBRN threat while minimizing or preventing collateral effects. Detailed weather, terrain, and population information is acquired, and collateral effects mitigated to the extent possible. When conducting operations in a CBRN environment, the JFC, component commanders, and unit commanders determine the fires and maneuvers necessary to counter WMD threats and avoid CBRN hazards that could affect timely achievement of JFC's objectives. CBRN threats and significant indigenous CBRN hazards are identified and considered during the JIPOE and targeting processes. Pertinent information collected by the units for each target is maintained in the target folder for use in a future response.

See JP 3-09, Joint Fire Support, *and JP 3-60,* Joint Targeting, *for additional information on fires and targeting.*

e. **Movement and Maneuver.** Accomplishing movement and maneuver in a CBRN environment can be more difficult, and in some situations, the JFC or unit commanders may direct movement and maneuver to avoid CBRN-contaminated areas. Preserving combat power from the effects of CBRN incidents is essential for commanders to seize, retain, and exploit the initiative. Maintaining movement control, keeping lines of communication open, managing reception and transshipment points, and obtaining HN support are critical to CBRN defense and continuing operations in a CBRN environment.

f. **Protection.** The purpose of CBRN defense measures is to provide the best protection against CBRN threats and hazards, to improve survivability by avoiding contamination, to continue the mission, and to reestablish the readiness of forces. Force health protection measures include those measures to protect the force from CBRN and other health hazards.

(1) JFCs rely on strategic guidance and interagency and multinational partners to identify and analyze CBRN threats and hazards, plan to prevent and protect against CBRN threats, and properly react to the release of CBRN hazards. Layered and integrated CBRN defensive measures reduce the effectiveness of WMD or other CBRN material releases. Protection measures defend against WMD by minimizing the vulnerability of the force to, and mitigating the effects of, CBRN incidents. Success depends on the effective use of unit and individual protective equipment; CBRN defense training; and tactics, techniques, and procedures (TTP). It is imperative that commanders consider identified CBRN threats and hazards and integrate appropriate CBRN defense measures into their mission planning.

(2) CBRN defense is improved when done in conjunction with multinational partners and the HN. While many multinational partners and HN forces maintain some CBRN defense capability, few maintain sufficient capacities, despite regional adversaries with some form of WMD; local CBRN hazards due to significant quantities of TIMs; or the prevalence of infectious diseases and the inability to manage, control, and contain their outbreak. Having sufficient CBRN defense capabilities and being prepared to react to a CBRN incident are key to preserving the joint force's fighting potential. Protection relies on intelligence and C2 for indications of CBRN threats and incidents. Multinational operations are especially challenging due to information sharing requirements and command and organizational differences.

g. **Sustainment.** The JFC should plan for operations in a CBRN environment due to the challenges of sustainment activities as well as the need for additional CBRN resources. The ability of sustainment planners to assess the potential effects of operating within CBRN environments is a critical factor in deciding priorities for CBRN defense and allocating and positioning resources. Normal logistics activities are affected when supplies and lines of communications become contaminated. The requirement for protective equipment and resources further burdens the supply system, maintenance processes, and use of logistics assets. A CBRN environment significantly impacts site selection for logistics bases and the need for transshipment points. Additionally, it increases water consumption rates due to decontamination and increased human consumption.

See JP 4-0, Joint Logistics, *and JP 4-02,* Joint Health Services, *for additional information on sustainment aspects within a CBRN environment.*

CHAPTER II
PLANNING

1. General

a. US forces should be prepared to conduct prompt, sustained, and decisive military operations in CBRN environments. Regardless of how material was released, a CBRN incident can create effects that disrupt or degrade operations to achieve US and multinational objectives. The planning, preparation, and sustainment considerations contained in this chapter assists JFCs and subordinate and supporting commanders with planning and preparation for military operations in a CBRN environment.

b. CCDRs consider potential adversary CBRN capabilities when developing their campaign or contingency plans. CCMDs map WMD and CBRN hazard sources; establish target folders; and plan for plausible, intentional, or unintentional releases of TIMs. This is critical, as their concentration could cause a CBRN environment detrimental to friendly forces movement and maneuver, especially in urban industrial areas. Campaign and supporting plans should include options for generating adequate and timely force capabilities in the event of early enemy CBRN employment in the supported area of responsibility (AOR) or other areas including the United States. CCDRs establish priority intelligence requirements and indicators to observe and collect information on an enemy's use, or impending use, of WMD or other CBRN threats; and to enable planning and actions to minimize their opportunities to create a CBRN environment and to mitigate the effects of a CBRN incident. US and HN policies may have restrictions on equipment and personnel returning from a CBRN contaminated environment preventing rapid redeployment.

2. Overview of Strategic and Operational Chemical, Biological, Radiological, and Nuclear Planning

a. **Strategic-Level Planning.** Factors that impact the CCMD's strategic-level CBRN planning include treaties; international law, customs, and practices; DoD policies; existing agreements/arrangements with HNs en route to and within the operational area; and the use of propaganda to influence US public and world opinion. Political factors, sociocultural factors, and economic characteristics of the OE assume increased importance for deterrence at the strategic level. These factors may, in fact, have an overriding influence on any COAs involving WMD. At this level, the analysis of the threat's strategic capabilities concentrates on considerations such as psychology of political leadership, national will and morale, ability of the economy to sustain industrial and technological capabilities for warfare, possible willingness to obtain or use CBRN weapons, and possible intervention by third-party countries and non-state actors, all weighed against US deterrence strategy and capabilities for attribution.

b. **Operational-Level Planning.** The use of threat assessments, capability assessments, and vulnerability assessments during the development of operational-level plans provides the commander and staff with shared understanding of the effects that may

OPERATION UNITED ASSISTANCE

In 2014, United States (US) forces deployed as part of Operation UNITED ASSISTANCE to the United States Africa Command area of responsibility to provide humanitarian assistance in response to the Ebola outbreak. Additional forces deployed from Spain and Italy. After successfully completing their mission, forces returning to the United States underwent a 21-day quarantine. Subsequently, Spanish and Italian government officials denied the return of US forces out of concern for those forces having been in a contaminated environment and the possibility of transmitting Ebola into the civilian population in their respective countries. After negotiations, US forces were allowed into Germany where they were quarantined for 30 days at Landstuhl Regional Medical Center. After German health officials provided independent verification that US forces were not carrying the Ebola virus, Spain and Italy allowed US forces to return to their home station bases. Other planning challenges for this operation included:

Installation sustainment plans. During operations, installations face challenges to sustain medical and protective equipment supplies. Installations should understand who manages and controls on-hand stocks.

Dissemination of modeling predictions. During operations, modeling supports decision making. Without rapid dissemination of an authoritative model (i.e., Joint Effects Model or Joint Warning And Reporting Network), any other available model used to inform initial risk decisions could compromise the joint force.

Relationships. Relationships should be firmly established before a crisis occurs, including with nongovernmental agencies and partner nations. Interoperability with other agencies is difficult and discovering this during the incident is too late.

Various Sources

be created by CBRN incidents within the OE. When examining the threat's order of battle, the analysis should include:

(1) Their release procedures for the use of CBRN weapons and means of delivery of WMD and any special operations forces (SOF) and paramilitary force capabilities.

(2) The characteristics and decision-making patterns (i.e., CBRN use, release procedures) of the threat's strategic leadership and field commanders.

(3) The threat's strategy, intention, or strategic concept of operations for use of CBRN weapons, which should include the objective, perception of friendly vulnerabilities, and intentions regarding those vulnerabilities.

(4) The threat's ability to integrate CBRN weapons into their offensive or defensive operations and into their overall concept of operations.

(5) The composition, disposition, movement, strength, doctrine, tactics, training, and combat effectiveness of threat forces with the ability to create CBRN hazards. Some specific capabilities to be evaluated in detail include:

(a) Principal strategic and operational objectives and lines of operation.

(b) CBRN strategic and operational sustainment capabilities.

(c) Ability to create effects in and through the information environment.

(d) Use of or ability to access data from space systems to support their targeting process.

(e) CBRN weapons, materials, and storage location vulnerabilities.

(f) Capability to conduct attacks against globally distributed friendly force critical support nodes.

(g) Ability to conceal or obscure initial deployment of or their responsibility regarding deployment of CBRN weapons.

(h) Relationship with possible allies and the ability to enlist their support.

(i) Capabilities for FP, and protection of the civilian population and infrastructure.

(j) Identities of personnel who may pose a threat.

3. Understanding the Effects of Chemical, Biological, Radiological, and Nuclear Employment on the Operational Environment

a. Command staffs strive to provide a perspective of the interrelated variables that make up their specific OE. The JIPOE process includes a detailed analysis of the various CBRN threats and hazards when defining the OE and determining appropriate COAs for forces.

(1) The JIPOE process analyzes the OE to identify possible adversary COAs related to the proliferation or employment of CBRN weapons or materials. Tailored JIPOE products assess the potential for accidental or deliberate release of CBRN materials within the operational area. Other products characterize the consequences of CBRN-related incidents and support the joint force's CBRN defense efforts.

(2) JIPOE analysis regarding adversary CBRN capabilities and intent is a particularly important prerequisite for military success during execution of a joint operation, regardless of how the CBRN environment evolves. Tailored JIPOE products provide the CCDR awareness of the evolving capabilities and limitations of adversary CBRN weapons and hazard delivery systems; technological advancements; changes to their command, control, and release procedures; and the indicators of intent to employ CBRN weapons. The objective is to give the CCDR an understanding of the risk of CBRN weapons use and implications to the joint force of an actual or threatened CBRN contaminated environment to enable more effective decision making.

(3) Red teams and wargames are closely associated with joint planning (primarily in COA analysis). Red teams enhance problem-solving efforts for complex operations like CWMD and civil-military operations such as domestic CBRN response and international chemical, biological, radiological, and nuclear response (ICBRN-R). Both red teams and wargame are used during planning and mission execution to assess decision points designed to deter or prevent adversary use of CBRN weapons or material and to optimize joint operations in a CBRN environment resulting from CBRN weapon use, industrial accidents, and sabotage or because of friendly actions.

b. The actual or threatened employment of WMD affects friendly forces by forcing them to prepare for or conduct CBRN defense activities, including contamination mitigation, and, if directed, CBRN response operations in support of civil authorities. The use or threat of use of WMD may also disrupt contractor and HN support. CBRN planning uses the four steps of JIPOE.

c. JFCs should account for the impact of information on their OE. They recognize employment of WMD has significant physical and psychological impact and may result in confusion, misunderstanding, and broad public panic if information is not properly managed. JFCs should be prepared to retain the information advantage through the free flow of factual and timely information.

(1) **Define the OE.** Intelligence support provides the information to support analysis of the OE.

(a) **Intelligence Support.** The intelligence community uses integrated operations and intelligence planning, including red team utilization, to advise the CCDR and subordinate JFCs of an adversary's possession of, access to, and capability to employ CBRN weapons or material. Throughout a continuous JIPOE process, tailored JIPOE products address the capabilities and limitations of adversary CBRN weapons; delivery systems; technological advancements; command, control, and release procedures; medical disease threats; and the indicators of intent to employ CBRN weapons. Further, the analysis includes information from the joint force surgeon, who assists and advises the JIPOE effort by identifying medical and disease threats in the OE. Additionally, the JIPOE process assesses the potential for sabotage of industrial and commercial TIM sources that are vulnerable to intentional release by an adversary or the unintentional release caused by an accident or collateral weapons effects within the operational area. JFCs and supporting and subordinate commanders should include treaty, legal, and policy considerations relating to CBRN in their JIPOE process.

For additional information on red teams, see JP 5-0, Joint Planning. *See DoDD 5240.01,* DoD Intelligence Activities*; DoDD 3025.18,* Defense Support of Civil Authorities (DSCA)*; and CJCSI 3125.01,* Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland.

(b) **Intelligence, Surveillance, and Reconnaissance (ISR).** ISR is an integrated operations and intelligence activity that synchronizes and integrates the planning and operation of sensors; assets; and processing, exploitation, and dissemination systems in direct support of execution of current and future operations. As an integrated intelligence and operation function, collection requirements should be specified and ISR missions executed to satisfy CBRN operational or technical threat requirements. ISR activities provide commanders and staff the ability to understand adversary CBRN threat capabilities. Measurement and signature intelligence is conducted both pre- and post-CBRN incidents. Key to ISR visualization is an effective management process to graphically display current and future locations of ISR sensors, including CBRN reconnaissance and surveillance capabilities, and their projected platform tracks. It also needs to display vulnerabilities to threat capabilities, meteorological and oceanographic phenomena, tasked collection targets, and products to provide a basis for dynamic redirection and time-sensitive decision making. This ability to redirect ISR capabilities allows the shifting of planned or ongoing collection activities in response to changed or improved situational awareness or directive. The JFC may also modify the commander's critical information requirements causing collection managers to reprioritize requirements.

1. **Intelligence.** Intelligence, derived from the continuous collection and processing of information and data, is used to assess adversary CBRN capabilities, dispositions, intentions, and other potential sources of CBRN hazards (e.g., industrial facilities). The intelligence function develops and tracks this information. When the intelligence concerns adversary CBRN capabilities, dispositions, and intentions, the CBRN defense community is also responsible for satisfying CBRN technical requirements for information.

2. **Surveillance.** The joint force conducts sustained, systematic, and continuous observation of an area for unforeseen hazard releases and monitoring of known hazard locations. Surveillance facilitates situational awareness and maintenance of an accurate, high-fidelity, real-time picture of the OE as changes occur. Surveillance involves standoff or point means (including those remotely dispersed, networked, unmanned, and unattended) to detect the presence or absence of hazards beyond the immediate vicinity of a friendly force to permit maneuver, avoidance of hazard locations, operations in stable environments, and support planning.

3. **Reconnaissance.** Reconnaissance provides the JFC with data about activities or conditions in a particular area of interest. Effective reconnaissance enables the JFC to avoid contamination and preserve combat power by providing detailed

information on potential CBRN hazards in the operational area. Reconnaissance may be conducted from air, space, or ground and supports sampling and hazard characterization capabilities. Ground reconnaissance may include marking of the hazardous area. Some hazards may be initially encountered by medical units such as veterinary or preventive medicine detachments.

For detailed information on tactical execution considerations, refer to ATP 3-11.37/MCRP 10-10E.7/NTTP 3-11.29/AFTTP 3-2.44, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance.

(c) **Medical Intelligence.** Medical intelligence is that category of intelligence resulting from collection, evaluation, analysis, and interpretation of foreign medical, bio-scientific, and environmental information that is of interest to military medical planning and operations, for the conservation of the fighting strength of friendly forces and the formation of assessments of foreign medical capabilities in both military and civilian sectors. Accurate and timely medical intelligence is a critical medical tool used to plan, execute, and sustain military operations. A supporting intelligence element should exist at some point in the medical unit's chain of command. This element, whether military or civilian, should be the primary source for the health services planner to access the necessary intelligence for the execution of health services operations. Medical surveillance consists of conducting disease surveillance to identify unusual patterns of disease emergence, as well as looking at the enemy's medical treatment capabilities and medical countermeasures (e.g., existing stock and items under development). If the adversary plans to deploy CBRN weapons, it is most likely to ensure it can protect its own force. Therefore, identifying adversary CBRN protective capabilities could serve as an indicator of the enemy's likelihood to employ CBRN weapons. In addition to the ongoing disease surveillance activities, the intelligence community evaluates the adversary's ability to deploy/employ medical assets as a method of determining real CBRN risks in the AOR. Medical intelligence can also include evaluation of protective measure effectiveness and effectiveness of medical response/treatment to CBRN elements. Intelligence of this nature would come from medical facilities treating patients after a CBRN event. The joint force surgeon determines medical priority intelligence requirements and include them in the commander's critical information requirements.

For further information on medical intelligence see JP 2-0, Joint Intelligence, *and JP 4-02,* Joint Health Services.

(d) With regard to CBRN threats and hazards, the analysis of the OE should encompass the following:

1. All countries or groups known or suspected of possessing a WMD capability and their intent or commitment to using it.

2. All current and potential locations of WMD delivery systems (e.g., missiles, rockets, artillery, aircraft, mines, and torpedoes).

3. All known and suspected adversary CBRN capabilities, including NTA development (e.g., fentanyl), and the location of their storage and production facilities.

4. Asymmetric CBRN threats that include covert means of delivery. Examples include radiological dispersal devices (RDDs) (also known as "dirty bombs"); improvised explosive devices (IEDs); or the use of CBRN materials against potential targets, such as the food, water, and supply systems or postal systems.

5. Advanced weapons or materials capabilities (e.g., nanotechnology, biotechnology, advanced genetics, space-based capabilities, and advances in computing that would allow more efficient access to information or production techniques).

6. Proliferation networks used to gain or transfer access to weapons, material, technology, and expertise.

7. Friendly and neutral nation-states' CBRN capabilities, including storage and production facilities and any CBRN hazards in the OE.

8. Friendly and neutral nation-states' capabilities and limitations to counter WMD, including CBRN defense and CBRN response.

9. Potential dual-use facilities or facilities that could be quickly converted to develop or produce WMD weapons, precursors, or materials.

(2) **Describe the Impact of the OE**

(a) Identify and evaluate the vulnerability of key friendly logistic facilities and infrastructure, including contractors and HN support, to CBRN attack.

(b) Identify known and suspected CBRN hazards in the operational area, including nontraditional sources (e.g., nuclear power plants and reactors, dual-use or commercial chemical manufacturing facilities, and medical facilities). Once identified, vulnerability assessments are conducted to further identify associated risks of adversary attack or exploitation such as CBRN-related material, capabilities, expertise, and sensitive/dual-use technologies.

(c) Identify weather features (e.g., wind, humidity, temperature), time of day, and terrain information needed to determine the effects of environmental impacts on potential CBRN hazards. Analyze the locally derived weather patterns, seasonal or monthly normal variations in climatic statistics, and terrain features that might affect the use of CBRN weapons and their potential CBRN environments.

(d) Analyze specific land and maritime areas that could be target areas for CBRN attack, such as choke points, key terrain, and transportation nodes.

(e) In addition to friendly force considerations, commanders and planners should consider what impact a release of CBRN materials would have on the local population. This is especially true when the joint force is operating amidst the civilian population, against an adversary that may have CBRN materials, or in areas that have a concentration of industrial sites containing TIMs. In either case, the JFC considers the availability of CBRN defense medical and nonmedical protection for civilian populations, in the event of a significant CBRN release.

See JP 3-06, Joint Urban Operations, *for additional information on impacts of CBRN threats in an urban environment.*

(3) **Evaluate the Adversary and Other Relevant Actors**

(a) Analyze adversary's and other relevant actors' capabilities and intent to employ specific types of WMD. Determine the locations, volume, and condition of adversary CBRN materials and potential hazards.

(b) Identify the specific types and characteristics of adversary and other relevant actor CBRN-related delivery systems, with special attention to minimum and maximum operational reach.

(c) Evaluate adversary and other relevant actor doctrine to determine if employment of CBRN weapons and devices or release of CBRN materials, including TIMs, is terrain-oriented, force-oriented, or a combination of both.

(d) Analyze the level and proficiency of adversary and other relevant actor training and experience in use of CBRN weapons and protective measures.

(e) Evaluate the practicality and timeliness of an adversary's and other relevant actors' exploitation of a new or different technology to develop a CBRN capability and delivery means.

(f) Evaluate an adversary's and other relevant actors' past or potential use of weapons, such as IEDs weaponized with CBRN materials.

(g) Evaluate an adversary's and other relevant actors' past use or potential capability to target or exploit CBRN hazards in the environment (e.g., power plants and reactors, production or storage facilities), including through cyberspace attacks or other asymmetric means.

(h) Identify and assess adversary's and other relevant actors' potential proliferation activities.

(i) Be prepared to participate in exploitation of identity intelligence to assist in identifying threat networks.

See JP 2-0, Joint Intelligence, *for additional information on exploitation support to counter threat networks. See JP 3-25,* Joint Countering Threat Networks, *for additional information on countering improvised weapon networks. For additional information on IEDs, see JP 3-42,* Joint Explosive Ordnance Disposal.

(4) **Determine Adversary and Other Relevant Actor COAs**

(a) Identify friendly assets the adversary and other relevant actors are most likely to target for CBRN attack.

(b) Determine locations where the adversary and other relevant actors are most likely to deploy delivery systems. These locations should be within range of potentially targeted friendly assets, yet still consistent with the adversary's deployment doctrine.

(c) Evaluate characteristics of the adversary's and other relevant actors' WMD or CBRN material stockpiles that may dictate or constrain their abilities to create CBRN weapons. These may include the age and shelf life of stored chemical munitions, the production and handling requirements for biological agents, and the quantity and yield of nuclear weapons.

(d) Determine types and quantities of CBRN materials likely to be employed by an adversary.

For additional information on JIPOE, see JP 2-0, Joint Intelligence, *and* Joint Guide for Joint Intelligence Preparation of the Operational Environment.

4. Chemical, Biological, Radiological, and Nuclear Hazard Awareness and Understanding

CBRN hazard awareness is the ability to use intelligence about CBRN threat dispositions and intentions and to determine the characteristics and parameters of CBRN hazards throughout the OE that impact decision making and consequently, CBRN defense activities. CBRN hazard understanding is the ability to individually and collectively comprehend the implications of the character, nature, or subtleties of information about CBRN hazards and their impact on the OE, mission, and force, to enable situational understanding (see Figure II-1). Planning the collection and exploitation of the CBRN threats and hazards information is essential for the JFC's situational awareness. When CBRN hazard awareness and understanding is combined with an understanding of the adversary, it can be used to enhance decision making and planning requirements.

a. Considerations for hazard awareness include:

(1) What CBRN threats may impact joint operations?

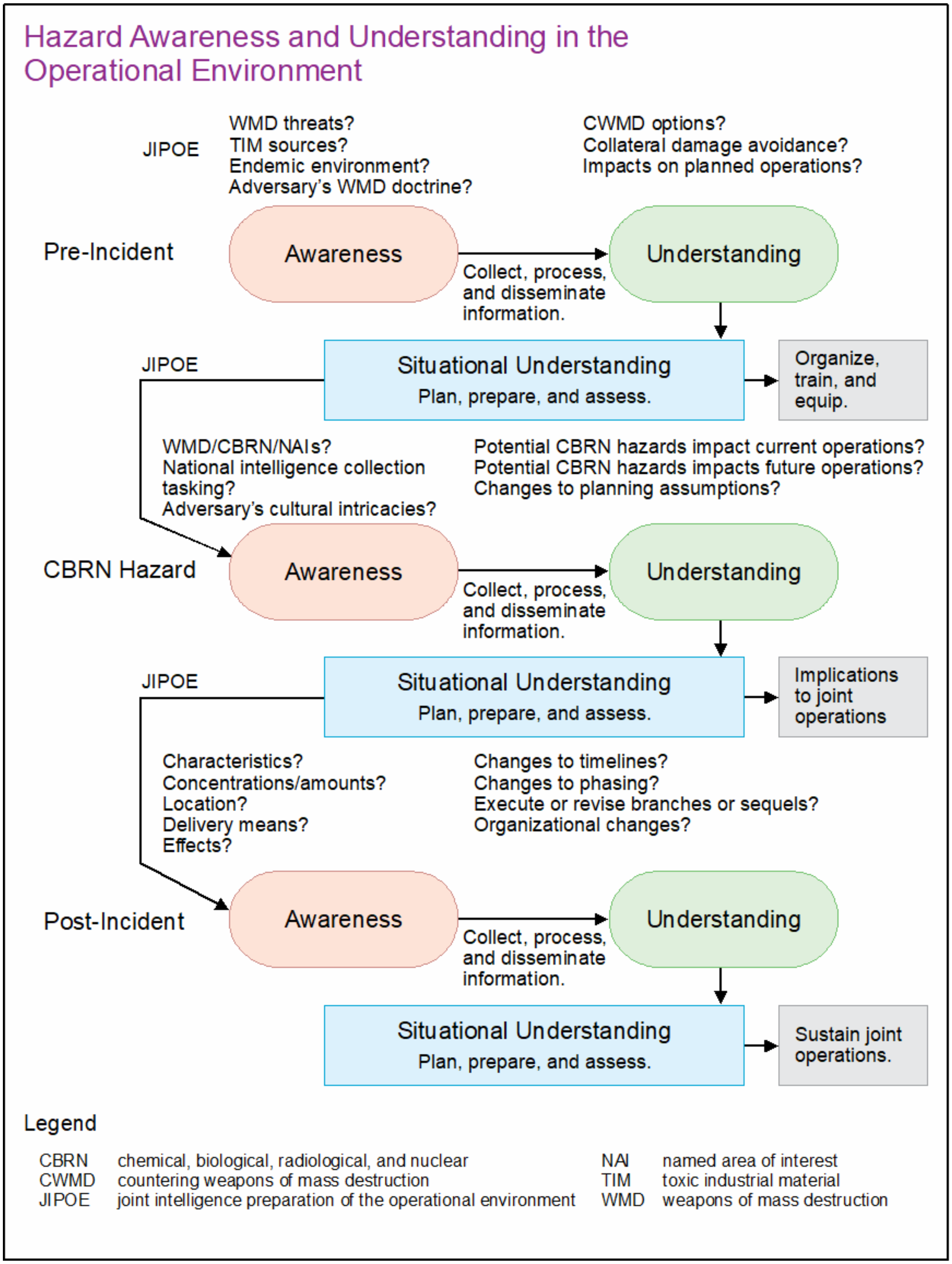

Figure II-1. Hazard Awareness and Understanding in the Operational Environment

(2) What are the adversary's cultural factors that might enable predictions about their motivation and COAs involving employment of WMD or CBRN hazards?

(3) What industrial, agricultural, medical, or research facilities may contain CBRN agents or TIMs that could be used by an adversary to cause a CBRN incident requiring a CBRN response?

(4) What friendly operations may be the source of collateral CBRN hazards?

(5) What are the types and locations of CBRN hazards present in the operational area?

(6) What are the characteristics of the CBRN hazards?

(7) In what concentrations or amounts are the hazards present?

(8) How are the hazards being brought into the operational area if they do not already exist there?

(9) What are the predicted short-term and long-term effects of the CBRN hazards?

(10) What are the environmental and climatological background data?

(11) What naturally occurring diseases, including animal and zoonotic diseases, are endemic to the local area and is there baseline health surveillance data for those diseases?

b. Considerations for hazard understanding:

(1) What effects do the potential sources of CBRN hazards have on current operations?

(2) What effects will the potential sources of CBRN hazards have on future operations?

(3) What are reasonable expectations for completing assigned missions in a CBRN environment?

(4) Do any planning assumptions have to be changed?

(5) What approaches need to be changed to facilitate the development of viable problem solutions?

(6) What changes are there to the strategic environment?

(7) What changes are there to the operational and tactical environment?

(8) What timelines should be changed?

(9) What phasing changes should be required?

(10) What branches or sequels need to be executed or redone?

(11) What organizational changes may need to be enacted?

(12) What does the CBRN threat or hazard indicate about the adversary?

(13) What are the JFC's current and future CBRN defense capability shortfalls and what can be done to mitigate these shortfalls?

(14) What number of casualties is the hazard likely to produce?

(15) What medical treatments may be needed to reconstitute the operational forces?

(16) What effects could potential CBRN hazards create on allies or partners?

5. Assessments and Risk Management

a. **Threat Assessment**

(1) The CBRN threat assessment helps commanders make better-informed decisions about which protective measures to adopt. It helps identify the most likely CBRN threats and hazards that units and personnel may face and allows units to identify the protective and vulnerability reduction measures most likely to keep them safe. When deciding on protective measures, commanders and staffs address two competing objectives:

(a) **Effectiveness.** Effectiveness is adopting appropriate protective measures that protect forces from specific threats that are most likely to occur, while maintaining the ability to accomplish the given mission or task and achieve the objective.

(b) **Efficiency.** Efficiency is avoiding the adoption of unnecessary protective measures that have significant costs (financial costs or diversion of time, effort, and focus).

(2) The CBRN threat assessment is not a one-time event but a continual process. Reevaluating CBRN threats and hazards should take place throughout planning and execution to ensure units continue to have appropriate protective measures in place. When conducting CBRN threat assessments, joint forces should:

(a) Conduct an initial CBRN threat assessment during planning and before operations begin and recommend the appropriate protective measures.

(b) Update the CBRN threat assessment at regular intervals (to help avoid subconsciously becoming habituated to previously identified threats and hazards) and whenever threats, hazards, or phases of operations change.

(c) Modify CBRN protective measures in accordance with threat assessment.

(3) The CBRN threat assessment is used to assign one of five standardized threat probabilities that are determined by the most current enemy or hazard situation as depicted by the continuously updated JIPOE process. While initially designed for use when analyzing an adversary's military and security forces, the CBRN threat status has expanded to also cover non-state actors and can be adapted for use in environments that pose accidentally created or naturally occurring CBRN hazards. This system allows commanders to increase the threat status as conditions change in their operational area. Threat status governs the initial deployment of CBRN assets (equipment, specialized units) and the positioning of those assets in the operational area. The JFC maintains authority to downgrade the threat level. Figure II-2, Chemical, Biological, Radiological, and Nuclear Threat Probability provides a description of the five probability levels. The probability of threat is defined below.

Chemical, Biological, Radiological, or Nuclear Threat Probability

Threat Level	Alarm Condition	Description
Minimal	**White**	There is no known threat with the capability and intention of conducting adverse actions using chemical, biological, radiological, or nuclear (CBRN) substances within the operational environment (OE).
Low	**Green**	A threat has been identified as possessing both CBRN substances and has the capability to target the joint force, but there is no indication of intent for immediate use. Although toxic industrial material (TIM) release is possible, infrastructure and security levels are robust.
Medium	**Yellow**	Employment of CBRN substances against the joint force within the OE is considered probable or there is an increased risk of TIM release due to a decay of infrastructure or degradation of the security for the infrastructure.
High	**Red**	A CBRN incident is assessed as immanent due to either attack or release of TIM due to damage to infrastructure or a lack of security for infrastructure.
Critical	**Black**	A CBRN incident has occurred and CBRN or TIM hazards are present.

Figure II-2. Chemical, Biological, Radiological, or Nuclear Threat Probability

(a) **Minimal Probability.** Actors within the OE do not possess CBRN defense equipment, are not trained in CBRN defense or employment, and do not possess the capability to employ CBRN weapons. Further, the opposing force is not expected to gain access to such weapons, and if they were able to acquire these weapons, it is considered highly unlikely the weapons would be employed against US forces.

(b) **Low Probability.** Actors within the OE have an offensive capability to create a CBRN hazard, have received training in defense and employment techniques, and may have expressed a willingness to use CBRN weapons, but there is no indication of the use of CBRN weapons in the immediate future. An indication may be the dispersal or deployment of CBRN materials/devices or the stated objectives and intent of opposing forces.

(c) **Medium Probability.** Actors within the OE are equipped and trained in CBRN defense and employment techniques. CBRN weapons and employment systems are readily available. CBRN weapons have been employed in other areas of the theater. The continued employment of CBRN weapons is considered probable in the immediate future. Indicators would be as follows:

1. CBRN weapons, or their normal means of delivery, are deployed.

2. Enemy troops wearing or carrying CBRN protective equipment.

3. CBRN reconnaissance elements observed with conventional reconnaissance units.

4. CBRN decontamination elements moved forward.

(d) **High Probability.** Actors within the OE possess CBRN materials and delivery systems, CBRN weapons have already been employed in the theater, and attack is considered imminent. In the case of nation-states, CBRN defense equipment is available and training status is considered at par or better than that of US forces. Indicators are:

1. CBRN attack in progress but not in the current operational area.

2. Enemy issues CBRN warnings/signals to their troops.

3. CBRN weapons within range of friendly forces.

4. Movement of surface-to-surface missiles to a launch site.

(e) **Critical Probability.** Actors within the OE have created CBRN hazards or a CBRN hazard exists in the OE. A post-attack environment is present or suspected, commanders should check their surrounding area for the presence of contamination and adjust protective measures accordingly.

b. **Friendly Capability Assessment.** In addition to continuously assessing the adversary CBRN capability, commanders also continuously conduct friendly force capability assessments from initial planning through all phases of the operation, as they assess how to best employ forces and equipment in a CBRN environment. This capability assessment is a comparison of the proficiency and resources required to support the commander against current unit capabilities for protection and CBRN defense, including the proficiency of individual CBRN staff officers, command posts, cells, and elements. It involves the continuous assessment of unit plans, organization, manpower, equipment, logistics, training, leadership, infrastructure, facilities, and readiness. The following list provides a representative sampling of various CBRN-related capabilities that require continuous assessment:

(1) CBRN forces.

(2) CBRN equipment.

(3) CBRN reconnaissance and surveillance.

(4) Collective protection (COLPRO).

(5) Decontamination.

(6) Automated warning and reporting.

(7) Hazard prediction and modeling.

(8) Medical countermeasures.

(9) Analytical capabilities available in theater and by reachback.

(10) Foreign and domestic CBRN defense capabilities.

(11) Communications systems, EMP hardening, and survivability.

(12) Information flow, exchange, and accuracy.

For information on messaging and countering disinformation see JP 3-04, Information in Joint Operations; *for information on EMP see JP 3-41,* Chemical, Biological, Radiological, and Nuclear Response, *and JP 3-85,* Joint Electromagnetic Spectrum Operations; *for information on the joint communications system, see JP 6-0,* Joint Communications System.

c. **Risk Management.** Implementing the full measure of CBRN passive defense should be a calculated decision made by the JFC. Providing full protection against CBRN threats and hazards can significantly degrade the operational capabilities of the joint force. The JFC weighs effective CBRN passive defense against two risks: the logistical cost to achieving mission objectives; and the cost of recovering force capabilities if an attack occurs without passive defense measures. Use of risk assessment and management tools enables the JFC to effectively execute a risk mitigation plan during operations in a CBRN environment.

6. Operational Challenges of Chemical, Biological, Radiological, and Nuclear Environments

a. **Deterring Adversary Employment.** A fundamental premise of US military planning is that adversaries are most likely to be deterred from provocative action when US forces are sufficiently and visibly organized, trained, and equipped to defeat the provocation and create a credible response. Deterring adversary use of CBRN weapons depends, to a significant degree, upon effective preparedness and operational readiness to deny the adversary any strategic advantage. Deterrence relies on many factors, including having credible plans, education and training, CBRN-focused exercises, and JFC's messaging indicating commitment to hold an adversary at risk following WMD employment. The adversary should perceive US capabilities and determination with certainty while remaining uncertain about the precise nature and timing of US countering actions. Synchronizing all information-related activities provides commanders with the principle means to deter a potential or actual adversary from taking any CBRN provocative actions that threaten US national interests. Depending on the nature of the threat (especially a non-state actor), the ability to conduct counter-IED activities and counter threat networks are important aspects of deterrence. However, not all non-state actors are significantly deterred by US force preparedness and capability.

b. **Reducing Vulnerability to Adversary CBRN Capabilities.** Vulnerabilities should be examined through continuous comprehensive assessments and integrated with risk management decisions that encompass the full range of potential targets subject to CBRN attack. Commanders have multiple means to mitigate the consequences of identified risks and hazards to preserve combat power and minimize casualties. Such means include planning for branches and sequels, eliminating unique threat network nodes, and synchronizing operations with subordinate units to prevent CBRN attacks. The protection working group serves as the primary advisor to the commander and staff for these issues.

(1) When US, HN, or other civilian populations and infrastructure are at risk from a CBRN attack, the JFC, when directed, assists the appropriate military and civil authorities in mitigating the risk, as well as protecting from and responding to an attack. Such efforts are often undertaken through a CCDR's building partner capacity program. Of particular concern to the JFC in this regard are CBRN risks to civilian areas that may affect execution of the military operations.

(2) Assessments and resulting vulnerability reduction measures should also address the dangers posed by TIMs. Particular care should be taken in identifying the nature of such hazards, because in many cases, standard military CBRN individual protective equipment (IPE) may not provide the necessary protection. In some instances,

avoiding the hazard may be the most effective or only COA. In all circumstances, the JFC should act to minimize immediate and long-term effects of toxic hazards.

(3) CBRN vulnerability assessments are essential to FP planning. They provide the JFC a tool to determine the potential vulnerability of an installation, unit, activity, port, ship, residence, facility, or other site against CBRN threats and hazards. The CBRN vulnerability assessment identifies functions or activities that are vulnerable to threats and require attention from the JFC to address improvements to withstand, mitigate, or deter against the threat. When improvements cannot be made, a risk-based approach to protection activities should be undertaken.

(a) The CBRN vulnerability assessment compiles the other types of assessments discussed into an overall snapshot of the unit's ability to support or conduct an operation given the specific OE and unit capabilities.

(b) The CBRN vulnerability assessment:

1. Identifies vulnerabilities.

2. Determines the likelihood the adversary uses CBRN threats or hazards to exploit a given vulnerability based on knowledge, technologies, resources, probability of detection, and payoff.

3. Predicts the potential impact to the operational area if the vulnerability is exploited.

(c) CBRN vulnerability assessments require a comparison of the threat with unit vulnerabilities to determine the efforts necessary to safely meet incident requirements. A vulnerability assessment also includes the integration of the commander's guidance through a risk management process to prioritize the implementation of vulnerability reduction measures.

(d) Given the factors in the risk equation and the cost of implementing CBRN defense measures, a determination may be made that the risk potential of a given vulnerability is not worth the cost of correcting or implementing a measure.

For chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE)-specific guidance and standards for DoD installations worldwide to use when preventing, protecting against, mitigating, responding to, and recovering from CBRNE incidents, see Department of Defense Instruction (DoDI) 3020.52, DoD Installation Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive (CBRNE) Preparedness Standards. *For additional detail on CBRN vulnerability assessments see ATP 3-11.36/MCRP 10-10E.1/NTTP 3-11.34/AFTTP 3-2.70,* Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Planning.

c. **Preventing Adversary CBRN Weapons Employment.** To reduce the likelihood of operating in a CBRN environment, the JFC should not rely solely on efforts to reduce vulnerabilities to CBRN attacks. JFCs should also make every effort within their authority to prevent the adversary from successfully acquiring and delivering CBRN weapons, using the full extent of actions allowed by the rules of engagement and rules for the use of force, as applicable. These actions include multiple lines of effort and are further discussed in JP 3-40, *Joint Countering Weapon of Mass Destruction.* However, understanding the consequences of execution prediction and assessment for WMD targets and TIM sites is essential during the joint targeting process.

For more detailed information about preventing adversary CBRN weapons employment, see JP 3-01, Countering Air and Missile Threats; *JP 3-03,* Joint Interdiction; *JP 3-09.3,* Close Air Support; *JP 3-25,* Joint Countering Threat Networks; *and JP 3-40,* Joint Countering Weapons of Mass Destruction. *For additional information on rules of engagement and use of force, see DoDD 5210.56,* Arming and the Use of Force*, and CJCSI 3121.01,* (U) Standing Rules of Engagement/Standing Rules for the Use of Force for US Forces.

d. **Conducting Multinational Operations**

(1) US military operations are routinely conducted with forces of other countries within the structure of an alliance or coalition. An adversary may employ CBRN weapons or material against non-US forces, especially those with little or no defense against these weapons, in an effort to weaken, divide, or destroy the multinational effort. When conducting combat operations, the JFC should consider the capabilities and limitations of all available forces to maximize their contributions and minimize their vulnerabilities. Peacetime activities with multinational partners, particularly multinational and interagency training and planning exercises, provide means of preparing for multinational combat operations in CBRN environments.

(2) With very few exceptions, multinational operations involve the use of HN sovereign airspace and territory, bases or civilian airports, facilities, and personnel (including non-USG and contracted civilian workers supporting US and multinational forces). The CCDRs' campaign and contingency plans and HN considerations, including passive defense, are the subject of significant peacetime planning in which operational, legal, contractual, and personnel issues are addressed. Coordination of HN support activities involves a number of interagency partners, as well as the US country team. Particular emphasis is placed on early warning and detection; actions to prepare US and indigenous military forces; and protection of threatened civilian populations, essential infrastructures, and facilities. Arrangements for custody and movement/disposal of captured CBRN materials and facilities should be made before operations commence. Allies may or may not take custody of various CBRN materials in areas under their control due to treaty obligations, training, and equipping or home government directions. The CCDR's staff should verify all plans and exercises are in alignment with HN agreements for providing assistance to the HN during CBRN incidents, especially where effects may hinder US military response.

(3) Targeting chemical, biological, or nuclear facilities as a part of multinational operations may be constrained by differing treaty obligations, multinational rules of engagement coordination requirements, and reporting requirements. The staff judge advocate and arms control advisor should be involved in the planning and targeting processes to identify applicable treaty obligations, multinational rules of engagement considerations, and reporting requirements.

For additional information on CBRN targeting, see JP 3-40, Joint Countering Weapons of Mass Destruction. *For additional guidance on offensive actions against WMD-related targets, see JP 3-05,* Joint Doctrine for Special Operations; *JP 3-09,* Joint Fire Support; *JP 3-60,* Joint Targeting; *and DoDD S-2060.04,* (U) DoD Support to the National Technical Nuclear Forensics (NTNF) Program.

e. **Synchronization of Operations.** Successful synchronization in CBRN environments includes the proper integration of, and sequencing among, intelligence collection capabilities, active and passive defense measures, offensive activities, CBRN response, and sustainment. The JFC's operation or campaign plan, C2 arrangements, and TTP should facilitate synchronization across all force functions and components. Installation commanders also synchronize base-level operations among all tenant units to maintain readiness and continuity of operations in CBRN environments.

f. **Integrated Early Warning (IEW).** IEW for CBRN threats and hazards includes material and nonmaterial capabilities that provide awareness and understanding of threats and hazards to support a commander's ability to make decisions. The information and actions that form the framework for IEW include:

(1) Intelligence. JIPOE provides background information on the possible agents, delivery mechanisms, and vulnerable areas.

(2) Air and missile defense capabilities, including actions taken to destroy missile threats, or mitigate the consequences of the attack by reducing its effectiveness.

(3) Non-CBRN sensors provide additional data points to help anticipate enemy actions.

(4) Hazard modeling and attack analysis to provide a prediction of the hazard and its potential effects on the current OE to inform commander decision making.

(5) Integration of both sensor and information networks and staffs to produce the information necessary to predict enemy actions and provide early warning.

(6) Decision support is needed to process and collate the information that can identify threats early enough to warn forces.

g. **CBRN Warning and Reporting.** The CBRNWRS provides a common system for initial reporting, creating hazard predictions, and reporting updated information on CBRN incidents. Standardized report content items, report templates, and prediction methods are used by joint and allied forces. Warning that a CBRN incident has or may have taken place, as well as identification of any potential hazard areas, should be rapidly disseminated to all units at risk. This information is critical for the prompt adoption of protective measures while also minimizing the effects of operating in IPE or COLPRO and the resultant adverse impacts on the operating tempo (OPTEMPO). It is important that information and records associated with warning and reporting advice are correctly logged, stored, and tracked for operational, lessons identified, and possible legal requirements.

For more on the CBRNWRS see Technical Manual (TM) 3-11.32/MCRP 10-10E.5/Navy Tactical Reference Publication (NTRP) 3-11.25/AFTTP 3-2.56, Multi-Service Reference for Chemical, Biological, Radiological, and Nuclear Warning and Reporting and Hazard Prediction Procedures.

h. **CBRN Facilities.** Planners should consider the risk of conflict near or directed at CBRN facilities or their occupation by adversary forces as part of threat assessments and prevention and mitigation measures as appropriate. Additional planning considerations for CBRN facilities in the area of operations may include:

(1) Personal safety and welfare, including sufficient staffing levels for safe operations.

(2) Safe transport of waste materials, particularly spent nuclear fuel, to dry storage facilities, where appropriate.

(3) Availability of waste storage, especially for highly radioactive waste.

(4) Providing CBRN emergency response assistance to allies and partners in the area.

(5) Ensuring a safe supply of fuel, water, maintenance parts and services, and other materials necessary for safe operations.

(6) Considering means to deter against adversary created CBRN incidents.

i. Adversaries may have a range of possible objectives with regard to CBRN facilities. Adversaries may threaten CBRN facilities as part of their deterrence posture or as a means of compelling fear in either local populations or friendly partners. They may aim to deny facility production to an opposing military, population, or government. Denying the production of a facility may be best achieved by attacking the connections between the facility and a wider power grid or transportation system, rather than the facility itself. Adversaries may threaten CBRN facilities to tie down friendly forces and fix them in or around the facility, or they may seek to suppress or destroy forces operating in the surrounding territory. An adversary may threaten a CBRN facility because a CBRN incident could deny an axis of advance. Adversaries may also secure the facility's production for themselves or to prevent other forces from having access. Lastly, adversaries might use CBRN facilities, such as nuclear power plants, as a safe haven to deploy their forces.

j. Commanders and their staffs develop plans and implement actions to counter adversary actions during peacetime and early in crises. These plans and activities require joint, multinational, and interagency coordination for activities that support CBRN awareness and understanding, protection of critical assets, and contamination mitigation measures.

7. Protection Planning

a. **Planning FP.** Protecting the force consists of those actions taken to conserve the force by identifying CBRN threats and hazards and preventing or mitigating the effects of operating in CBRN environments. CBRN-related protection includes measures taken to keep CBRN environments from having adverse effects on personnel, equipment, resources, or critical assets and facilities. Offensive and defensive measures are coordinated and synchronized to enable the effective employment of the joint force while degrading opportunities for the adversary. FP is an integral part of managing the impact of force entry in complex operating environments. CBRN protection is provided throughout all phases of an operation, including surveillance/reconnaissance through the actual assault and then resupply and refit. From the adversary's viewpoint, contaminating ports, landing zones, drop zones, and beach landing areas with CBRN hazards buys time and space and is a combat multiplier. Planning and considering a mix of types of protective resources helps balance operational requirements with optimal CBRN protection and sustainment.

(1) Commanders implement protective measures appropriate to all anticipated threats, including terrorist threats and the use of CBRN weapons or other sources of CBRN hazards. This requires planning, preparation, and training to execute defenses to negate the effects of CBRN elements on personnel and materiel. Measures include IPE/personal protective equipment (PPE); receiving medical countermeasures, including vaccinations and other pre- and post-exposure prophylaxis measures as well as treatments, including force health protection prescription products such as chemical agent antidote auto-injectors; implementation of restriction of movement (ROM) policies; and COLPRO systems to provide protection in CBRN environments.

(2) The protection joint function extends beyond FP to encompass protection of US civilians; the forces, systems, and civil infrastructure of friendly nations; and other USG departments and agencies, international organizations, governmental organizations, and nongovernmental organizations.

(3) Protection capabilities for military forces against CBRN hazards also apply domestically. Commander, United States Northern Command, Commander, United States Indo-Pacific Command, Chief, National Guard Bureau, and subordinate commanders, when tasked by the Secretary of Defense (SecDef), can apply protection capabilities during homeland defense, domestic CBRN response for defense support of civil authorities, and for emergency preparedness. DoD may be capable of preventing certain CBRN incidents

during homeland defense, but DoD does not normally have resources to provide individual protection or COLPRO for the general population against CBRN hazards resulting from a CBRN incident.

b. **Force Health Protection.** Medical protection of the force against CBRN threats involves integrated preventive, surveillance, and clinical programs. The JFCs and subordinate and supporting commanders' plans should take into account the capabilities and requirements of HNs, multinational and interagency partners, international organizations, nongovernmental organizations, and essential civilian workers supporting US and multinational forces. Commander's plans should include:

(1) Pre-exposure medical countermeasures (i.e., vaccination, pretreatments, and other prophylaxis measures).

(2) Patient decontamination and preventive medicine activities.

(3) Diagnostic testing activities (including designation of field confirmatory and theater validation identification laboratories for medical and environmental specimens).

(4) Post-exposure prophylaxis (e.g., certain vaccinations with post-exposure indications and antibiotics).

(5) Treatment (e.g., chemical agent antidotes and antibiotics or antivirals), including supportive care (e.g., use of mechanical ventilation).

(6) Disease-containment strategies (i.e., ROM, including isolation or quarantine), comprehensive health surveillance and biosurveillance, food and water protection activities, and CBRN exposure data capture.

For further information on comprehensive health surveillance see JP 4-02, Joint Health Services.

c. **Biosurveillance.** Biosurveillance is the process of gathering, integrating, interpreting, and communicating essential information related to threats or disease activity affecting human, animal, or plant health. Biosurveillance helps achieve early detection and warning, contributes to overall situational awareness of the health aspects of an incident, and enables better decision making at all levels. It is conducted to quickly detect and characterize potential incidents of significance that affect human, animal, or plant health. Rapid detection and enhanced situational awareness are critical to saving lives and improving incident outcomes, whether the result of a bioterror attack or other WMD threat, an emerging infectious disease, pandemic, environmental disaster, or a foodborne illness. Key processes include constant scanning of the environment and rapid evaluation to detect threats and assess their severity. Information sources include not only human health but also animal, plant, and environmental health. Medical intelligence capability and products directly link to biosurveillance and health efforts.

For information on biosurveillance, see ATP 4-02.7/MCRP 3-40A.6/NTTP 4-02.7/AFTTP 3-42.3, Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment.

d. JFCs preserve their forces' fighting potential by minimizing the effects of hostile action. The protection function includes mitigation of the effects of CBRN incidents through preparation, rehearsal, and timely incident response. The timely response to any CBRN incident includes the earliest possible detection and identification of the CBRN contaminants. These actions help limit both complications of the contamination and further spread of any communicable illnesses. The results can also support preliminary attribution to implicate or support trace analytics for the source of the identified CBRN material. The CCMD staff facilitates the expedited transport of CBRN samples and specimens within their AORs by ensuring procedures and adequate units or personnel are in place to provide proper technical escort from any land or maritime point of contamination to the closest in-theater laboratory with appropriate analytical capabilities.

e. **Protective Equipment.** Sufficient equipment should be available to protect the uniformed force and mission-essential personnel. Individual and unit training on proper sizing, use, and care for IPE and, where appropriate, PPE is required to take full advantage of its capabilities.

(1) IPE is the personal clothing and equipment provided to all military personnel to protect them from CBRN hazards. In addition to IPE for personnel, military working dog handlers and veterinarians should be consulted to determine the appropriate measures for working dogs which may include specialized kennels, goggles, and booties.

(2) PPE is mission specific physical protective equipment worn to minimize exposure to hazards that may cause serious injury, illness, or impairment of function through absorption. Examples of PPE include specialized protective equipment, such as level A/B protective suits worn together with self-contained breathing apparatus, that meets civilian certifications as required by the United States Department of Labor Occupational Safety and Health Administration. PPE may be worn to protect the face, head, and extremities by use of protective clothing; respiratory devices; and protective shields and barriers to protect personnel from hazards capable of causing injury, illness, or impairment in the function through absorption, such as inhalation, physical contact, or radiation.

(3) In addition to IPE and PPE, United States Transportation Command (USTRANSCOM) has a limited number of negatively pressurized conexes [containers express] that are certified for containing high consequence infections during aeromedical evacuation. Air Mobility Command retains aeromedical teams trained and equipped to treat and air-transport patients with airborne or droplet-transmitted diseases.

For more information on current cleanliness policy and air evacuation of contaminated patient policy refer to Department of the Air Force Instruction 48-107, Volume 1, En Route Care and Aeromedical Evacuation Medical Operations; *DoDI 6000.11,* Patient Movement (PM); *and JP 3-41,* Chemical, Biological, Radiological, and Nuclear Response.

f. **Emergency Management and CBRN Response Measures.** Adversaries challenge FP capabilities at home stations even before deployment, through the threat of using CBRN weapons. Joint installation commanders manage and maintain comprehensive, all-hazards installation emergency management programs on DoD installations worldwide. The DoD Chemical, Biological, Radiological, and Nuclear Enterprise supports and assists civil authorities in emergency management activities to mitigate, prevent, protect, respond to, and recover from natural or man-made CBRN incidents.

For additional information on emergency management and response see DoDI 6055.17, DoD Emergency Management (EM) Program, *and CJCSI 3125.01,* Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland.

(1) **Protection of Critical Assets.** Protection focuses on conserving the joint force's fighting potential in four primary ways: **active defensive measures** that protect the joint force, its information, its bases, necessary infrastructure, and lines of communications from an adversary's attack; **passive defensive measures** that make friendly forces, systems, and facilities difficult to locate, strike, and destroy; **application of technology and procedures** to reduce the risk of friendly fire; and **emergency management and response** to reduce the loss of personnel and capabilities due to enemy action, accidents, health threats, and natural disasters. Protection includes actions taken to reduce the vulnerability of critical resources, including personnel, facilities, equipment and supplies, and information to deter or neutralize incidents and their effects.

(a) Basic objectives for operations and campaigns include rapid and uninterrupted force preparation and deployment, comprehensive FP, and adherence to the law of war.

(b) Mission-oriented protective posture (MOPP) is a flexible system of protection against CBRN contamination in which personnel are required to wear protective clothing and equipment appropriate to that threat level and work rate imposed by the mission, temperature, and humidity. Commanders may adjust the MOPP-level or dress state gear required in their particular situations to maintain combat effectiveness. Additionally, commanders may place all or part of their units in different MOPP levels (i.e., split-MOPP) or other variation within a given MOPP level. When operating with allies and partners (especially non-NATO nations), JFCs should establish a shared understanding of the MOPP system and reconcile inconsistencies associated with the various protective posture systems adopted by partner nations.

(c) JFCs should be familiar with MOPP systems used for maritime and land operations (see Figure II-3). Ship MOPP includes integrated detection, individual protection, COLPRO, and decontamination actions, while land MOPP focuses on individual protection.

Joint Ship/Land Chemical, Biological, Radiological, and Nuclear Mission-Oriented Protective Posture Comparison

Ship MOPP		Land MOPP		NATO	
Level	**Description**	**Level**	**Description**	**Dress State**	**Description**
MOPP Ready	Not applicable.	MOP Ready	Carry protective mask with load-carrying equipment. Store IPE at nearby logistical site (< 2 hours).	For all NATO dress states, respirator is issued or carried. Respirator should be appropriate to specified risk.	
MOPP 0	PE onboard and inventoried; all personnel sized and assigned IPE.	MOPP 0	Carry mask, and have IPE within arm's reach.	ZERO	All items issued and immediately available.
Not Used		Mask Only	Wear mask. This level is used only under command direction.	Not Used	
MOPP 1	IPE issued to all personnel and available.	MOPP 1	Don protective suit.	ONE	Suit worn; foot protection, gloves, and respirator/ mask carried.
MOPP 2	Carry mask, replace installed training filter with a serviceable filter canister from their kit bag. Have other IPE available. Activate detectors. Set condition modified ZEBRA (ship hatch closure/secure measure).	MOPP 2	Don protective boots.	TWO	Suit and foot protection worn; respirator/mask, and gloves carried.
MOPP 3	Don protective suit. Don protective boots. Set condition ZEBRA (ship hatch closure/secure measures). Activate intermittent washdown.	MOPP 3	Don protective mask. Secure hood.	THREE	Suit, foot protection, and gloves worn; respirator/mask carried.
MOPP 4	Don protective mask. Secure hood. Don protective gloves. Set condition Circle WILLIAM (ship ventilation/secure measure) as required. Activate continuous wash down.	MOPP 4	Don protective gloves	FOUR	Suit, foot protection, gloves, respirator/mask worn.

Legend

IPE	individual protective equipment	NATO	North Atlantic Treaty Organization
MOPP	mission-oriented protective posture		

Figure II-3. Joint Ship/Land Chemical, Biological, Radiological, and Nuclear Mission-Oriented Protective Posture Comparison

For more information on MOPP system flexibility, see ATP 3-11.32/MCRP 10-10E.11/NTTP 3-11.27/AFTTP 3-2.46, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological and Nuclear Protection, *and NTTP/Coast Guard TTP 3-20.31*, Surface Ship Survivability.

(d) Sustaining operations in CBRN environments may require COLPRO equipment, which provides a toxic-free area for conducting some activities and performing life support functions such as rest, relief, and medical treatment. In planning for the use of COLPRO, an assessment of the capabilities of the available COLPRO systems should be included. Proper planning and coordination with CBRN subject matter experts (SMEs) assists in the effective use of COLPRO.

(e) When COLPRO is not available, plans are developed, exercised, and evaluated to move personnel to alternative toxin-free areas that are well away from the contaminated areas. The use of split-MOPP procedures may be appropriate in such situations. If evacuation is not possible, building occupants may be able to shelter in place to gain limited protection by closing all windows and doors, turning off ventilation systems, and moving to closed, inner rooms. If there is advance warning, occupants can increase protection by sealing windows, doors, and openings; however, sealed buildings or spaces may quickly become uninhabitable without cooling or ventilation.

(2) **Contamination Mitigation.** Contamination mitigation is the planning and actions taken to prepare for and recover from contamination associated with all CBRN hazards, to contain the spread of CBRN contamination, and to prevent the loss of assets. Planners should provide clear guidance for contamination mitigation and integrate it into appropriate planning products to prevent confusion with CBRN response. Staffs utilize CBRN hazard awareness and understanding (see Figure II-1) to match CBRN mitigation measures to the hazard, determine necessary capabilities needed to limit the spread of contamination and neutralize the effects, prioritize and coordinate mitigation actions and resources, and establish measures to assess mitigation efforts. Biological incident mitigation may involve community mitigation measures. A proactive approach to contamination mitigation is achieved through planning and preparation.

8. Preparation Considerations

a. During preparation, the focus is on deterring and preventing adversaries from taking actions that affect combat power. Since the joint force is most often vulnerable to surprise and attack during preparation, the implementation of hazard awareness and understanding activities, protection of critical assets, and contamination mitigation measures with ongoing preparation activities assists in the prevention of negative effects.

b. The fundamental elements for maintaining adequate preparedness require a clear understanding of the threats and operational requirements, both overseas and in the United States. To support these requirements, the commanders' mission analyses identify specific, mission-essential tasks for individuals and organizations that facilitate operations in CBRN environments. DoD is also responsible for homeland defense against employment of WMD directly against the United States and supporting homeland security against possible covert CBRN threats. Domestic military support, known as defense support of civil authorities, is subject to constitutional, statutory, and policy restrictions.

For further planning considerations, see JP 3-28, Defense Support of Civil Authorities, *and CJCSI 3125.01,* Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland.

c. Intelligence collection and analysis are finite capabilities and subject to the JFC's prioritization. Changes in the perceived magnitude or severity of the threat when compared to friendly vulnerability and risk limitations often dictate adjustments or changes to the plan when those threat characteristics exceed the acceptable level of risk to the friendly force established in planning. During preparation, the staff continues to monitor and evaluate the overall situation and update the commander's critical information requirements. Variable threat and hazard assessments may generate new priority intelligence requirements, while significant changes in friendly capabilities or vulnerabilities could lead to new friendly force information requirements. Additionally, operations in the homeland are complicated by intelligence oversight laws.

d. During preparation commanders and staffs should:

(1) Revise and refine the plan.

(2) Employ systems to detect CBRN threats and hazards and provide early warning of any hostile activities.

(3) Collect and analyze CBRN threat and hazard data.

(4) Monitor adversary and joint force preparation activities and revise assessments.

(5) Request support to reinforce logistics preparations and replenishment.

(6) Assess joint force Service components training and readiness requirements.

(7) Expedite the procurement and availability of resources needed for protection against CBRN weapons.

(8) Synchronize efforts with USG departments and agencies and multinational partners.

(9) Monitor joint force and facility preparations to operate in CBRN environments.

e. As the staff monitors and evaluates the performance or effectiveness of the friendly COAs, intelligence assets collect information that may verify adversary COAs. As the nature of the threat evolves, risk to the force changes and may require a different CBRN protective posture or the implementation or cessation of specific CBRN measures and activities. The staff analyzes changes or variances that may require modifications to the priorities and obtains additional commander's guidance, when necessary.

(1) Specific activities to enhance hazard awareness and understanding during preparation may focus on the collection and exploitation of information gained from CBRN reconnaissance and surveillance, as well as from health surveillance, to develop and refine the common operational picture of the OE. Relevant information collections can help fill in information gaps, refine potential threats and hazards data into facts, validate assumptions, and finalize the plan.

(2) Multiple sources provide units with relevant information, which is processed, extracted, formatted, and forwarded. Commanders and their staffs evaluate the information to assess its impact on operations and protection. The assessment may lead to directives/orders to help protect against the effects of the assessed CBRN hazard. Commanders may direct an integrated series of protective measures (e.g., adjust MOPP) to decrease the level of risk (e.g., decrease threat of exposure), and the plan is revised as updated information is received. MOPP analysis of the appropriate levels of protection based on hazards, mission, environmental conditions, and time constraints informs the commander's decision.

(3) Forces prepare for contamination mitigation activities by monitoring current operations, assessing resource readiness, preparing mitigation packages, and synchronizing the contamination mitigation capabilities. Some situations require unique application of decontamination TTP. These considerations should take into account command, control, and communications planning required for decontamination of strategically significant areas/terrain or facilities. Other factors requiring consideration include standing up/deactivating a task force, selecting and defining joint decontamination operations sites, and establishing the manning allocation of initial headquarters for such decontamination operations.

For additional decontamination considerations, see Appendix F, "Contamination Mitigation Considerations."

For specific information on tactical decontamination operations and levels, see ATP 3-11.33/MCRP 10-10E.12/NTTP 3-11.26/AFTTP 3-2.60, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Mitigation.

(a) **Patient Decontamination.** Patient decontamination reduces the threat of CBRN contamination to medical personnel, other patients, and the health care facility. Patient stabilization treatment to conduct decontamination should not be delayed unless contamination puts the patient at greater risk. Trained and qualified triage personnel determine priority of treatment and decontamination. Aeromedical evacuation capabilities for contaminated and contagious casualties are very limited. Medical movement of contaminated patients in the strategic air evacuation system requires consultation with medical authorities, concurrence between the CCDR with an assigned AOR and Commander, USTRANSCOM, and approved by SecDef. When military working dogs are in use within the area of operations, planners consider the unique treatment and decontamination requirements.

For additional information on air movement of contaminated patients, see JP 3-41, Chemical, Biological, Radiological, and Nuclear Response.

(b) **Sensitive Equipment Decontamination.** Sensitive equipment decontamination considers the delicate nature of certain types of equipment (e.g., avionics or electrical, electronic, and environmental systems), aircraft and vehicle interiors, associated cargo, and some weapon systems. Due to the corrosive properties of most decontamination solutions, sensitive equipment decontamination options are limited. Best practices include employing contamination avoidance measures (including COLPRO and remote/point detection systems) to prevent or mitigate the effects to the interior contamination of vehicles, aircraft, and ships.

(c) **Aircraft/Aircrew Decontamination.** Aircraft and aircrew pose unique decontamination challenges.

1. **Aircraft Decontamination.** Spot decontamination can be used as an immediate measure to mitigate unintentional transfer and spread contamination on aircraft that may require servicing between sorties, to support ingress and egress of aircraft by crews and passengers, or if performing pre- or post-flight inspections; however, clearance decontamination is required for unrestricted use of aircraft for international flight operations, transportation, and maintenance. Other alternatives include exposure of more aged and higher-hours platforms with a view toward rework or disposal that is less impactful to readiness or end strength. See Appendix F, "Contamination Mitigation Considerations," for additional information on aircraft decontamination considerations.

2. **Aircrew Decontamination.** Aircrew decontamination enables the crew to transition from a potentially contaminated environment with clothing or gear that was exposed to hazardous material. Aircrew flight equipment technicians determine the level of exposure and instruct the crew on procedures for removing IPE/PPE. Base support agencies standby to support crew decontamination procedures and advise on health risk. Base support includes medical technicians, intelligence support (to obtain classified material), bioenvironmental support, and vehicle operations.

(d) **Sealift Decontamination.** The availability of clearance decontamination capabilities is necessary to ensure the unrestricted use of the Ready Reserve Force when under the operational control of Military Sealift Command for strategic sealift. To achieve this level of cleanliness, specialized teams with more sensitive detection equipment may be required. Near-term operational employment decisions can have long-term strategic consequences, because this level of decontamination is time-consuming and expensive, thus potentially reducing future unit availability. Considerations include limited shipyard and contractor resource capabilities for conducting decontamination operations at this level. Therefore, the JFC should strive to limit the intentional CBRN exposure of sealift ships to only those missions considered critical. JFC plans should take into account these challenges in considering employment of sealift ships to transport contaminated cargo or passengers or to operate in contaminated areas.

(e) **Fixed-Site Decontamination.** Fixed-site decontamination techniques focus on fixed facilities and mission support areas, such as communications systems, C2 facilities, intelligence facilities, supply depots, aerial and sea ports, space operations facilities, medical facilities, and maintenance sites.

(f) **Cargo Decontamination.** Safely package contaminated cargo in accordance with hazardous materials procedures or decontaminate prior to transport. To minimize the spread of contamination and risks to personnel, the JFC should limit the retrograde of contaminated or formerly contaminated cargo to critical items that are preidentified in JFC plans, unless the cargo has been assessed to be safe or meets clearance standards. Every effort should be made to provide shipment traceability of contaminated or formerly contaminated cargo. Additionally, destination and transit countries may deny overflight and landing clearances to aircraft carrying contaminated cargo. US Presidential approval may be required for these shipments. Post-conflict redeployment of contaminated assets may require extensive decontamination measures (to include extended weathering) and the use of specialized teams and highly sensitive detection and monitoring equipment. In-place destruction/disposal of contaminated equipment may be necessary; detailed documentation pertaining to the in-place destruction of contaminated material is retained by appropriate authorities.

For information on policy, responsibilities, and procedures for the clearance of chemical, biological, or radiological-contaminated platforms and materiel, see Department of Defense Manual 3145.03, DoD Chemical, Biological, and Radiological (CBR) Clearance Guidance for Platforms and Materiel.

(g) **Terrain Decontamination.** Absorption of CBRN materials by terrain surfaces may affect the mission by limiting mobility corridors. The decontamination of terrain speeds the weathering process, potentially opening critical terrain to use, and allows personnel to increase stay time in an area. Terrain decontamination requires extensive resources in terms of equipment, material, and time and is therefore limited to areas of critical importance.

(h) **Mass casualty decontamination.** Mass casualty decontamination consists of the neutralization or removal of CBRN agents and materials from a large number of contaminated personnel, minimizing further risks to health and facilitating subsequent treatment.

(i) **Food and water decontamination.** Food and drinking water supplies should be protected from potential contamination. If contamination has occurred or is suspected, consult with veterinary services and preventive medicine for testing and decontamination. On-site destruction/disposal of contaminated subsistence may be necessary.

For information on the decontamination and disposition of food, see ATP 4-02.7/MCRP 3-40A.6/NTTP 4-02.7/AFTTP 3-42.3, Multiservice Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment.

9. Other Planning Considerations

a. Planning supports the commanders' decision cycle. Focused JFC staff planning related to conducting operations in CBRN environments includes:

(1) Establish cooperative policies, procedures, and networks to integrate CBRN defense for the joint force, other interagency members, HN, and multinational partners to operate in a CBRN environment.

(2) Recognize the most likely CBRN threats and hazards from updated adversary tactics, capabilities, intentions, and the environment.

(3) Conduct assessments (threat, vulnerability, previous incident/past use, impact, meteorologic/oceanographic, hazard prediction modeling).

(4) Provide recommendations for the critical asset list and defended asset list.

(5) Coordinate unit protection measures, especially IPE, troop safety criteria, operational exposure guidance (OEG), automatic masking criteria, bypass criteria, COLPRO equipment, and decontamination equipment and procedures.

(6) Establish the appropriate recovery and mitigation actions to match the threat, hazards, and locations.

(7) Coordinate logistics activities, personnel services support, health services (including vaccinations, medical countermeasures, and veterinary services if applicable), and reconstitution efforts.

(8) Coordinate CBRN health surveillance activities (including biosurveillance and the distribution of prophylaxis) through the applicable command surgeon channel.

(9) Synchronize the policies, people, and processes for expedited collection, transport, and analysis of medical specimens, food, water, and environmental samples from CBRN incidents.

(10) Provide commanders' guidance for forces and facilities to ensure they are prepared to operate in CBRN environments.

(11) Establish procedures for processing, decontaminating, and disposing of contaminated equipment and clothing.

(12) Establish procedures for processing and repatriating contaminated human remains.

(13) Establish a communication plan with redundancy to include primary, alternate, contingency, and emergency means of communication.

b. Specific planning considerations may vary significantly between different phases of a joint operation/campaign at the strategic, operational, and tactical levels, due to differences in the responsibilities and authorities at those levels for the application of C2, complexity of assigned missions, available resources, and the size of the operational areas and areas of interest. The use or the threatened use of WMD or CBRN materials can dramatically influence strategic and operational objectives and COAs. Planners and commanders at all levels should integrate CBRN defense and other FP considerations into the overall planning and decision-making processes.

c. **Directed CBRN Response; ICBRN-R.** During any phase of operations, the JFC may need to support CBRN response/ICBRN-R tasks, including assisting HN forces as they conduct CBRN response operations. Red teams can aid commanders and staff in thinking critically and creatively for complex operations like domestic CBRN response and ICBRN-R.

d. **Information Integration into Operations.** In CBRN environments, information plays a crucial role in creating effects in the information environment that deter or counter adversary efforts to employ WMD, create CBRN effects, or heighten the chaos attendant with their use. CBRN-related messaging planning should include adversaries and their supporters, friendly forces and partners, and potentially affected local populations. Effective integration of information also enhances the JFC's ability to respond to such incidents, disseminate accurate information in a timely manner, allay fears and misunderstanding, and build support where necessary to achieve desirable outcomes. Failure to maintain information advantage can have significant negative impact on the JFC's response mission. Therefore, information considerations should be part of planning from the outset and considered throughout preparation, execution, and assessment.

For further information, see JP 3-04, Information in Joint Operations.

(1) The integrated employment of information activities may reduce force vulnerability and help deter adversarial use of CBRN weapons. Public interest in and fear of CBRN-related developments may be intense and may affect US and multinational leadership decisions. National-level communications can create international and internal pressures to convince an adversary not to acquire or use CBRN weapons. Fully explaining the USG position on the potential US reaction in the event of an enemy use of CBRN materials on US or multinational forces could be very beneficial. The JFC should provide, as the situation requires and release authority exists, timely and accurate information to the public regarding actions taken in reaction to CBRN threats, hazards, or incidents. The JFC and the staff public affairs officer are the primary official military spokespersons for this purpose.

(2) A combination of other information activities, including electromagnetic spectrum operations, cyberspace operations, military information support operations, military deception, and operations security, can influence, disrupt, corrupt, or usurp the adversary's decision-making process, and can be vital to the success of the overall operation or campaign. Information activities may help prevent an adversary from

acquiring information necessary to successfully target friendly forces and facilities using CBRN weapons.

For further guidance on communications related to CBRN incidents, see National Security Presidential Memorandum 36, (U) Guidelines for United States Government Interagency Response to Terrorist Threats or Incidents in the United States and Overseas.

For further details on public affairs, see JP 3-61, Public Affairs.

e. **Legal Guidance.** The complexity of operations in CBRN environments, and associated law and policy, require involvement of the staff judge advocate, or appropriate legal advisor for planning, arms control and treaty compliance, and assessment of operations. Because of the global nature of some CBRN threats, this may include continuous consultation with interagency and multinational partners, HN governments, and international organizations to establish the necessary legal authorities, capabilities, and limitations associated with such organizations. The staff judge advocate advises the JFC and staff of potential legal issues (e.g., compliance with domestic environmental regulations, legal implications of CBRN planning, and targeting in a CBRN environment).

(1) **International Law.** The staff judge advocate advises the JFC and staff on international law that may generate constraints and restraints that shape CBRN planning efforts.

(2) **Conventions, Treaties, and Other International Agreements.** Arms control and nonproliferation treaties and agreements establish international norms opposing the proliferation of WMD, their precursors, means of delivery, and weapons manufacturing equipment. Such treaties and agreements define the international standards under which signatories may be held accountable and provide diplomatic tools and legal recourse to isolate and punish violators. These treaties and agreements also shape the OE by imposing planning limitations and reporting requirements. Arms control SMEs are available to support operational planning and execution. In sum, international treaties and agreements may increase or limit US options with regard to logistical support, security assistance, and status of forces.

f. **Operational Contract Support.** The CBRN planner should identify units/organizations responsible for providing spaces, equipment, protective clothing, and decontamination/recovery for contractors authorized to accompany the force. Effective operational contract support is critical to expedite the procurement of material and services in support of a CBRN operation. The operational contract support integration cells coordinate operational contract support, are permanent organizations at CCMD and Service component headquarters, and may be activated at the joint task force level. Requirements may include the decontamination of government-owned animals such as military working dogs. At a minimum, the CBRN planner should consider:

(1) Assessing and minimizing requirements for contracted support in or near a CBRN environment.

(2) Reviewing contractor qualifications or certifications required to support a CBRN requirement.

(3) Identifying medical support available and accessible to contractors authorized to accompany the force responding to a CBRN event.

(4) Providing education and training to contractors authorized to accompany the force regarding CBRN procedures, communications, and reporting.

(5) Implementing procedures for contractors authorized to accompany the force access to or restrictions from a CBRN-affected area.

(6) Designating authority to properly dispose of contaminated waste.

(7) Coordinating requirements and considerations with the operational contract support integration cell.

See JP 4-10, Operational Contract Support, *and Chairman of the Joint Chiefs of Staff (CJCS) Manual 4301.01,* Planning Operational Contract Support, *for additional information.*

See JP 3-41, Chemical, Biological, Radiological, and Nuclear Response, *for additional information on CBRN response.*

10. Sustainment Considerations

a. Sustainment is the provision of logistics and personnel services to maintain operations through mission accomplishment and redeployment of the force. Sustainment provides the JFC the means to enable freedom of action and endurance and to extend operational reach. Sustainment determines the depth to which the joint force can conduct decisive operations, allowing the JFC to seize, retain, and exploit the initiative. For operations in a CBRN environment, unique sustainment considerations should include:

(1) Procuring, storing, and managing an appropriate amount of IPE/PPE, decontaminants, consumables, and other CBRN defense supplies to outfit all units arriving into the area of operations for the purpose of conducting personnel and equipment protection and sustained decontamination operations.

(2) Coordinating the resupply of CBRN defense and monitoring equipment. CBRN-related equipment is often commercial off-the-shelf and may need special consideration for maintenance and replacement.

(3) Conducting contamination mitigation.

b. The Defense Health Agency is a combat support agency that enables United States Army, United States Navy, and United States Air Force medical services to provide a medically ready force and a ready medical force to CCMDs. The agency supports delivery of integrated, affordable, and high-quality health services to military health system beneficiaries. Additional considerations include:

(1) Maintaining force health protection and public health measures.

(2) Coordinating health services, medical readiness, food and water protection, mass casualty management, and mortuary affairs.

For more information on health support services, refer to JP 4-02, Joint Health Services.

c. Maintaining adequate logistics support is more difficult for operations in CBRN environments. Key considerations include the application of the joint logistics principles of sustainability, survivability, responsiveness, and flexibility to provide adequate CBRN equipment stocks and to support interoperability. The application of these principles in a CBRN environment is described as follows:

(1) **Sustainability.** Sustainability is the measure of the ability to maintain logistics expiration dates and anticipation of future requirements. In an active CBRN environment, water usage dramatically increases for both human consumption and decontamination.

(2) **Survivability.** Theater logistics sites and units present an adversary with important and often high-value, fixed targets for CBRN attack. Protection planning should include both active and passive defense measures to minimize the risks from CBRN attacks while satisfying the needs of the joint force for uninterrupted logistics support.

(3) **Responsiveness.** The potential damage and environmental conditions caused by CBRN incidents may require relocation of bases and medical facilities, major redirection of supply flow, reallocation of transportation and engineering services, and short-notice transfer of replacement personnel or units from one part of the theater to another. Plans should allow for surges in logistics requirements for CBRN defense consumables and equipment items to appropriate units.

(4) **Flexibility.** Work/rest cycles should be implemented to the maximum practical extent allowed. Maintaining logistics flexibility in CBRN environments requires logistics units be capable of rapid alteration of work schedules. CBRN incidents can cause degradation of logistics activities due to having to operate in protective clothing and decontaminate supplies and equipment. Logistics plans should include means for protective covering and sheltering of essential items against contamination.

(5) **CBRN Defense Equipment Stocks.** Logistic support for CBRN defense readiness includes providing adequate supplies and transportation of CBRN defense equipment, as well as assisting as necessary any CBRN defense organizations directly responsible for carrying out reconnaissance, decontamination, and supporting tasks.

(6) **Interoperability.** In operations outside the continental United States, when the JFC is likely working with HN and other forces, each member organization of a multinational operation is responsible for its own CBRN defense. The ability to exploit logistic interoperability (e.g., in equipment and supplies) can contribute to the effectiveness of the collective CBRN defense.

(7) **Training.** Individual and unit survival skills and the ability to perform mission-oriented tasks while in protective clothing are vital to theater logistic activities. Mission-essential tasks should be identified in theater plans and unit standard operating procedures, and regular training and certification should be conducted to establish individual and unit proficiency.

d. **Logistics Supportability Analysis.** The logistics supportability analysis provides a broad assessment of core logistics capabilities required to execute plans and define the total logistics requirement for execution of a concept of operations. Because of the potential impact of CBRN contamination on logistics support and support requirements, collaboration with CBRN experts is essential in this process. The CBRN staff can highlight potential deficiencies in supply forecasts (protective equipment, decontaminants, and filters) that may result from contamination; risks to the logistics support mission attributed to CBRN threats; and additional CBRN defense capability requirements that may result from exposure of logistics units, equipment, or facilities to CBRN contamination.

e. Operations in CBRN environments make sustainment planning more complex. OPTEMPO, logistic and maintenance operations, health services, personnel services support, and reconstitution efforts may be profoundly affected by the introduction of CBRN hazards that can create distinct challenges to personnel, units, equipment, and operations. The ability to assess the potential effects of CBRN weapons and hazards on the mission is a critical factor in deciding priorities for CBRN protection and efficiently allocating resources.

See Appendix F, "Contamination Mitigation Considerations," for additional decontamination considerations.

CHAPTER III
EXECUTION

1. General

a. Joint operations require adaptability and flexibility during execution, particularly in CBRN environments. The application of operational art and operational design provides the operational approach and promotes unified action for planning and execution.

b. Execution applies the planning considerations described in Chapter II, "Planning," in support of joint operation plans. During execution, planning considerations for operating in CBRN environments support JFC decision making during all phases of an operation.

(1) During execution in a CBRN environment, the staff assesses how CBRN threats, hazards, and incidents have affected operations.

(2) Assessment recommendations concerning the impact of CBRN environments on joint operations help commanders adjust operations and the application of resources, determine when to develop and execute appropriate branches and sequels, and align current and future operations with the mission (see Chapter IV, "Operation Assessment," for additional information). Execution continues until the mission is accomplished or termination criteria have been met.

c. Along with unity of command, centralized planning and direction and decentralized execution are key considerations in how JFCs organize and employ their forces. While JFCs may elect to centralize some functions, they should avoid reducing the versatility, responsiveness, and initiative of subordinate forces. JFCs should allow Service component and SOF organizations and capabilities to function generally as they were designed. However, the JFC should account for differences in Service component and SOF capabilities in CBRN environments when synchronizing operations. Commanders should use situational leadership to maximize operational performance and overcome the ambiguities and uncertainties inherent in combat operations, especially when faced with a CBRN environment.

For detailed information on tactical execution considerations, refer to Field Manual 3-11, Chemical, Biological, Radiological, and Nuclear Operations, *and ATP 3-05.11,* Special Operations Chemical, Biological, Radiological, and Nuclear Operations.

2. Hazard Awareness and Understanding and Situational Awareness

a. The JFC and staff share information to create the shared understanding required to make informed and timely decisions amid massive quantities of operational data. Even a small or isolated CBRN incident may produce significant quantities of data that challenge decision makers if the capability to evolve from initial data gathering to full situational awareness does not exist. There is an evolution from a first bit of data provided by a CBRN sensor (or a group of sensors linked to provide a more complete picture of a large facility, city, or region) or another indicator of CBRN exposures (e.g., medical diagnosis) to full situational awareness of the implications of a CBRN incident based on shared information. The information concerning the causes of CBRN incidents and environments (hazard awareness) should be properly processed, managed, and shared to create the necessary shared understanding (hazard understanding) that results in the wisdom essential to sound decision making. Sharing of CBRN hazard awareness and hazard understanding may be accomplished through antiterrorism or FP or by establishing CBRN working groups.

(1) CBRN environmental information should be rapidly shareable and easily assimilated within the JFC's common operational picture.

(2) Smart technology, data sharing, networked sensors, and situational awareness capabilities should be used to inform the joint force of the CBRN hazard. These capabilities provide the joint force access to CBRN expertise, support decision-making to reduce exposure and avoid hazards, and preserve combat power.

For a more detailed discussion of creating shared understanding, see JP 3-0, Joint Campaigns and Operations.

b. **CBRN Hazard Understanding.** CBRN hazard understanding is the dynamic collective comprehension of the implications of emerging CBRN environments within the OE, facilitating the framing of problems and decision making during execution.

c. The CBRNWRS plays an instrumental role in achieving situational understanding. Awareness of a CBRN hazard results in warnings, alerts, and reports that provide hazard data, which is key to decentralized operational decisions at all levels within the joint force. Awareness allows for the rapid warning and alerting of affected personnel who employ CBRN protective equipment and mitigation capabilities to negate the effects of the CBRN incident and help sustain operations. The JFC processes this awareness of a CBRN incident to gain an understanding of its implications to joint operations.

For more information on CBRNWRS, refer to TM 3-11.32/MCRP 10-10E.5/NTRP 3-11.25/AFTTP 3-2.56, Multi-Service Reference for Chemical, Biological, Radiological, and Nuclear Warning and Reporting and Hazard Prediction Procedures.

d. CBRN hazard awareness is achieved through the expert analysis of the information provided through the fusion of CBRN detectors and collected intelligence. The intelligence community collects and analyzes information about adversary CBRN capabilities and intentions, along with other potential sources of CBRN hazards. When the intelligence community has concerns about adversary CBRN capabilities, dispositions, and intentions, the CBRN defense community is responsible for satisfying CBRN technical information requirements. As part of the JIPOE process, neutral and friendly activities that may be sources of potential CBRN hazards are also considered and analyzed. Predictive modeling assists in understanding how hazards are affected by weather and terrain. This informs decision making regarding FP measures such as split-MOPP considerations and restrictions on movement during an operation. The Interagency Modeling and Atmospheric

Assessment Center coordinates and disseminates atmospheric dispersion modeling and hazard prediction products during operations.

e. **CBRN Hazard Identification.** Identification verifies the identity of a CBRN hazard and provides more information about its properties and attributes. There are four levels of identification associated with CBRN hazards: presumptive, field confirmatory, theater validation, and definitive. The higher the level of identification, the higher confidence the commander has of employing a tactical response and that leadership has in identifying the source of the hazard, which can support attribution.

(1) **Presumptive identification** is the employment of technologies with limited specificity and sensitivity by forces in a field environment to detect the presence of a CBRN hazard with a low but sufficient level of confidence to support immediate tactical decisions.

(2) **Field confirmatory identification** is the employment of technologies with increased specificity and sensitivity by technical forces in a field environment to identify CBRN hazards with a moderate level of confidence and the degree of certainty necessary to support follow-on tactical and operational decisions.

(3) **Theater validation identification** is the employment of multiple independent, established protocols and technologies by scientific experts in the controlled environment of a fixed or mobile/transportable laboratory to characterize a CBRN hazard with a high level of confidence and the degree of certainty necessary to support operational to strategic-level decisions.

(4) **Definitive identification** is the employment of multiple state-of-the-art, independent, established protocols and technologies by scientific experts in a nationally recognized laboratory to determine the unambiguous identity of a CBRN hazard with the highest level of confidence and the degree of certainty necessary to support strategic-level decisions.

f. **Situational Understanding and Decision Making.** Applying decisions based on the shared understanding of the CBRN situation also requires understanding when to deploy and employ CBRN defensive capabilities such as IPE and COLPRO:

(1) **Deploy CBRN Defense and Protection Assets.** Deployment encompasses all activities from origin or home station through destination and specifically includes not only each stage of movement but also reception, staging, and onward movement and distribution. Examples of deployment decisions that might be needed:

(a) Where to deploy CBRN defense and protection assets?

(b) How much CBRN detection and identification equipment to deploy?

(c) When to deploy CBRN medical assets?

(d) What type of CBRN decontamination materials to deploy?

(e) Has CBRN response been tasked within the operational area, or should CBRN response be anticipated during the assigned mission?

(2) **Employ CBRN Defense and Protection Capabilities.** Examples of employment decisions that may need to be made:

(a) Which CBRN contamination mitigation assets to employ?

(b) Where to employ CBRN defense medical assets?

(c) When to employ CBRN reconstruction and stabilization assets?

(d) Where to employ CBRN response enterprise assets, if directed?

3. Protection

a. **General.** The use of WMD, or presence of CBRN hazards, in a joint force's operational area requires specific actions to safeguard both the force and mission. Throughout the operation or campaign, the JFC employs active defense measures, such as air and missile defense and physical security, to defend against conventionally and asymmetrically delivered WMD. These capabilities deny an adversary the benefit of the use of CBRN threats and can influence their decision to employ them. These capabilities also represent benefits to allies and partners and can influence their support as well. The JFC employs CBRN defense capabilities (e.g., integrates IPE and other equipment to protect against WMD and CBRN, employs medical countermeasures, or demonstrates to an adversary that personnel are trained) to reduce or negate vulnerabilities and minimize the effects of CBRN contamination. CBRN defense measures also protect US military interests, installations, and critical infrastructure. When WMD or CBRN hazards are encountered, the joint force focuses on controlling the effects of the release of the CBRN hazard, mitigating the threats, and then transitioning control to a competent authority for final disposition as the situation or mission dictates. These protection steps are undertaken whenever a joint force encounters a CBRN hazard and may be carried out incidental to the original mission or as a specified CWMD mission.

b. **Safeguard the Force and Manage Response.** The purpose of this activity is to allow the joint force and other mission-critical personnel to sustain effective operations and support US and foreign civil authorities and their populations by responding to a CBRN incident and mitigating its hazards and effects. When conducted on a small scale, safeguarding the force and managing response tasks may constitute part or all of a crisis response or limited contingency operation. Within the construct of such activities, the joint force needs to be prepared for a variety of WMD or CBRN weapon situations, including an adversary's deliberate use, inadvertent release, release due to joint force action, or actor of concern's employment of CBRN materials.

For more information to safeguard the force and manage response, see JP 3-40, Joint Countering Weapons of Mass Destruction, *and JP 3-41*, Chemical, Biological, Radiological, and Nuclear Response, *respectively.*

4. Contamination Mitigation

a. **General.** Planning for contamination mitigation is discussed in Chapter II, "Planning." As part of execution, contamination mitigation enables joint forces to sustain operations in a contaminated environment without prolonged interruption of OPTEMPO. It also enables the quick restoration of essential capabilities or combat power required to accomplish the current mission and achieve operational objectives. Only if directed should the joint force conduct CBRN response in support of the civilian populations, to contribute to life saving and, as needed, maintain or restore essential services to support critical life supporting activities. Contamination mitigation includes planning, initiating, and continuing operations despite the potential for CBRN hazards through the conduct of contamination control and decontamination.

b. **Contamination Control.** The joint force quickly responds to contamination by initially mitigating the effects and performing only those actions required to allow continuation of the mission and, within mission constraints, save lives. A CBRN incident may contaminate essential operating areas and local commanders need the capability to control the contamination of affected areas. Large, fixed sites (e.g., ports, airfields) with excess throughput capacity may allow split-MOPP operations implementation, which provides the flexibility to shift operations to uncontaminated locations on the installation. For smaller facilities operating at full capacity, an incident could reduce throughput to a level below the JFC's requirements. Controlling contamination of equipment and operating surfaces at fixed sites is required to minimize impacts to operations. Depending on the hazards present, some sites may not be able to return to full capacity without decontamination.

c. **Decontamination.** The joint force conducts decontamination of personnel, equipment, operating surfaces, materials handling equipment, aircraft, vessels, food and water, and exposed military cargo to the extent required to sustain operations within contaminated environments and limit the spread of contamination throughout the OE. The OPTEMPO and mission determine the level of decontamination required. The joint force should be prepared to conduct mass casualty decontamination operations.

d. **Recover from Contamination.** The joint force maintains access to resources and capabilities to mitigate any hazardous contamination to recover/maintain unit readiness for the required range of mission activities at acceptable contamination levels.

For more information on decontamination activities and levels, see ATP 3-11.33/MCRP 10-10E.12/NTTP 3-11.26/AFTTP 3-2.60, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Mitigation.

5. Sustainment Considerations

a. **General.** Operations slow as personnel encumbered by protective equipment or exposed to CBRN environments perform tasks. This may require abandonment or limited use of contaminated areas, transfer of missions to uncontaminated forces, or avoidance of contaminated terrain and routes. Additionally, the use of WMD or other CBRN incidents resulting in a major disruption of normal personnel and materiel replacement processes in the theater could severely hamper the commanders' capabilities for force generation and sustainment.

(1) Split-MOPP options could make available many forces that would otherwise have been unavailable due to unnecessary protective level constraints. Force reconstitution requirements may also dramatically increase over initial planning estimates. Even when sufficient protection has been afforded to individuals and units, continued operations in a CBRN environment could overburden reorganization and reconstitution capabilities, as well as the deployed military health system capabilities.

(2) Understanding the nature of CBRN contamination is central to JFC decisions to reduce the risk of casualties and cross-contamination and the rapid resumption of operations after an incident. Coordinated reconnaissance, detection, identification, and marking is required. Personnel conduct self-assessment activities to detect possible contamination in their individual areas; however, military units trained and equipped to conduct CBRN reconnaissance are normally necessary to support JFC understanding of CBRN contamination in the OE.

For more information, refer to ATP 3-11.37/MCRP10-10E.7/NTTP 3-11.29/AFTTP 3-2.44, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance.

b. **Logistics in CBRN Environments.** Logistics are particularly vulnerable to CBRN incidents. Movement of supplies and maintenance of equipment slows in CBRN environments. The resources needed for recovery from CBRN incidents can severely strain the theater logistic system and cause unanticipated effects on combat operations. Other logistics considerations may include:

(1) Increased water requirements for personnel and equipment decontamination operations.

(2) Large amounts of contaminated waste.

(3) Inventory shortages of low-density CBRN protective equipment may require unplanned movement of these critical supplies.

(4) Disruption of supply routes to avoid contaminated areas.

(5) Increased maintenance of contaminated equipment.

(6) Increased consumption of decontaminants and consumables required by decontamination units.

(7) Class I supplies may be contaminated and may need to be replaced before decontamination can occur.

c. **Medical Logistics.** The threat of CBRN weapons against US military personnel constitutes a tremendous medical planning challenge. Planned medical countermeasures range from the routine management of medical materiel used for individual protection to planning responses for events that may produce catastrophic numbers of casualties. The level of investment in materiel and other countermeasures for anticipated response to a CBRN incident depends upon the JFC's assessment of the threat and directives for planning and materiel readiness. Medical logistics considerations may include:

(1) Managing medical biological and chemical defense materiel.

(2) Positioning and composition of CBRN response sets.

(3) Mitigating disruption of Class VIII distribution channels.

(4) Mitigating CBRN threats to medical units.

(5) Reconstituting medical logistics networks.

(6) Partnering with other USG departments and agencies.

(7) Deploying environmental laboratories to analyze suspected CBRN samples in the operational area.

For more information on medical logistics, refer to JP 4-02, Joint Health Services.

d. **Handling of Contaminated Materiel, Equipment, and Human Remains**

(1) **Materiel and Equipment.** CCDRs with assigned AORs are responsible for the decontamination of all materiel and equipment exposed to CBRN contamination to clearance level before it is returned to stock or retrograded from the theater. Thorough planning and Service TTP are used to protect individuals against low-level CBRN hazard exposure, conserve valuable assets, identify requirements for the return of equipment and personnel to the United States, and maintain DoD life cycle control of previously contaminated equipment. Due to the limitations of decontamination technology in meeting all safety and health standards, some contaminated equipment may require extensive weathering to meet safety standards. In some cases, equipment may be so grossly contaminated that reuse or repair is not practical and in-theater destruction may occur.

(a) In accordance with current publications, contaminated materiel and equipment that cannot be decontaminated for operational use is marked, segregated, and disposed of or decontaminated after the cessation of hostilities. Theater plans and orders provide guidance and procedures for retrograde of contaminated materiel and prioritize selected items that, due to their essential nature and short supply, require immediate retrograde, repair, and subsequent return to the theater. For retrograde of equipment via mobility air forces airlift, cargo is decontaminated to a clearance level sufficient to prevent aircraft contamination.

(b) The length of time contaminants pose a hazard varies.

1. Chemical agents dissipate based on the properties of the agent and its reaction to heat, light, and humidity. For chemical agents designed to dissipate slowly, decontamination operations can quickly reduce the hazards to acceptable levels.

2. Depending on the type, biological contamination can potentially be reduced to safe levels within hours after dissemination due to exposure to sunlight, relative humidity, wind speed, and temperature gradient. However, encapsulation or genetic engineering may protect agents from natural deterioration and increase their persistency. Decontamination operations can reduce or contain hazards posed by biological agents.

3. The length of time radioactive material poses a hazard is determined by its decay rate, a function of the half-life of the radionuclide, and cannot be reduced. If the residual radiation cannot be removed, commanders employ the principles of time, distance, and shielding. Commanders should minimize the time personnel are exposed to the radiation source; maximize the distance between personnel and the radiation source; and place as much shielding material, such as walls or soil, between personnel and the radiation source as is operationally feasible. Using appropriate protective equipment can inhibit inhalation and ingestion of the radiological hazard.

(c) Equipment retrograde and redeployment requires lift resources that should be protected from contamination. Only critical retrograde cargo should be moved from a contaminated location onto uncontaminated aviation and maritime lift. Critical requirements are designated in theater plans. The intent to retrograde residually contaminated equipment is thoroughly coordinated through the CJCS, DoD, USTRANSCOM, and other relevant USG departments and agencies due to potential foreign and domestic risks and diplomatic/environmental sensitivities. The approval authority for landing contaminated aircraft at locations in areas outside of the United States or its territories is coordinated through the Department of State and the HN. Requests for approval to land such aircraft are made through the appropriate CCMD, which seeks Department of State approval. Requests for landing contaminated aircraft within the continental United States or territories is coordinated by the Headquarters United States Air Force/Deputy Chief of Staff for Plans and Operations, who seeks DoD approval. DoD coordinates with applicable civilian authorities and only issues guidance on contaminated aircraft movement after obtaining approval from the President or SecDef. CCDRs are responsible for cargo processing, to include packaging, technical escort, reception and staging, and foreign and interagency coordination; compliance with applicable US and international laws; compliance with treaties, conventions, and agreements to which the

United States is a party; and compliance with DoD policies on international and domestic CBRN response.

(2) **Human Remains.** The CCDR with the assigned AOR has the responsibility to search for, recover, tentatively identify, and deliver US human remains to the theater mortuary evacuation point. To complete this task, the JFC establishes a mortuary affairs contaminated remains mitigation site. This site is an operational element under the oversight of the joint mortuary affairs office and is manned by specialized mortuary affairs and CBRN personnel.

(a) In some circumstances, the JFC may need to authorize alternative procedures for the disposition of human remains. If remains are contaminated, all efforts are made to mitigate the contaminant and render safe for transport. If human remains cannot be decontaminated to a safe level, decontamination capabilities are not available, or if there are other public health and safety concerns, contaminated human remains may have to be temporarily interred or stored in a manner that contains the CBRN hazard, and the location should be properly marked to facilitate contamination avoidance. Protecting the health of Service members and the public takes precedence over rapid repatriation of remains.

(b) Temporary interment or temporary storage of remains is the recommended method of disposition until safe handling procedures and materials can be identified. Authority for temporary interment outside the United States resides with the CCDR. The appropriate joint mortuary affairs office directs and controls subsequent disinterment. Temporary interments require dedicated transportation assets to avoid the spread of contamination, engineer support to prepare the site, and security personnel to prevent unauthorized personnel from entering the interment area.

e. **Operational Considerations Associated with Pandemic and Infectious Disease Response.** Freedom of movement, access, placement, and information exchange are greatly impacted by the pandemic response and mitigation measures. Planners factor in additional time and coordination to account for ROM, isolation, and quarantine measures. For example, individuals demobilized following a pandemic response may not be immediately available for operational employment.

For joint doctrine for handling contaminated human remains, see JP 4-0, Joint Logistics.

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CHAPTER IV
OPERATION ASSESSMENT

1. General

In the context of planning and executing military operations, assessment is a continuous process that measures the overall effectiveness of employing joint force capabilities. Assessment involves deliberately comparing forecasts with actual events to determine the overall effectiveness of force employment. Specifically, an assessment process primarily helps the JFC and component commanders, and potentially other partners, determine progress toward accomplishing a task, creating a condition, or achieving an objective. Assessment should not be confused with the intelligence function that provides intelligence assessments of the OE in the context of JIPOE. However, tailored JIPOE products, based on continuously updated intelligence requirements that include operation assessment indicators, can serve as major contributions to all levels of the assessment process of an operation or campaign. Assessments are applicable in all military operations. The JIPOE process supports assessment by helping the commander and staff decide what aspects of the OE to measure and how to measure them to determine progress toward accomplishing tasks and setting conditions necessary to achieve an objective. Based on their assessments, commanders direct adjustments, thus focusing the operation on accomplishing the mission. Assessment of operations conducted in CBRN environments increases the quantity and nature of variables that are considered and analyzed to provide commanders with the most viable COAs. Planning and preparing for the assessment process begins with the initial stage of joint planning, and during mission analysis the initial set of mission success criteria normally becomes the basis for assessment. Assessment considerations help guide operational design because they can affect the sequence and type of actions along lines of operation and lines of effort.

2. Operation Assessment Process

The assessment process is directly tied to the commander's decision cycle throughout planning, preparation, and execution of operations. It entails three distinct tasks: continuously monitoring the situation and the progress of the operations, evaluating the operation against measures of effectiveness and measures of performance to determine progress relative to the mission and objectives, and developing recommendations or guidance for improvement.

a. Staffs help the commanders by monitoring the numerous aspects that can influence operations and providing the commander timely information needed for decisions. The assessment process approved by the commander helps the staff by identifying and monitoring key aspects of the operation the commander is interested in and where the commander wants to make decisions.

b. Normally, the operations or plans directorate of a joint staff, assisted by the intelligence directorate, is responsible for coordinating assessment activities. For subordinate commanders' staffs, this may be accomplished by equivalent elements within Service or joint functional components.

c. During planning, the staff analyzes threats, hazards, vulnerabilities, and capabilities to assist commanders in determining and refining priorities, task organization decisions, logistics and health services, intelligence collection requirements, resource allocation, and readiness requirements. The assessment process should identify activities required to maintain situational awareness, monitor and evaluate staff estimates and tasks, develop and monitor measures of effectiveness and measures of performance, and identify potential variances that could require decisions.

d. During execution, the staff monitors and evaluates the progress of current operations to validate assumptions made in planning and to continually update changes to the situation. The staff also monitors the conduct of operations, looking for variances. When variances exceed threshold values developed or directed in planning, the staff may recommend an adjustment, such as an order to counter an unanticipated CBRN threat or hazard or to mitigate a developing vulnerability. They also track the status of assets and evaluate their effectiveness as they are employed.

e. The staff should monitor and evaluate the following aspects of the CBRN environment as part of the assessment process:

(1) Changes to CBRN threats and hazards.

(2) Changes in force vulnerabilities to CBRN hazards.

(3) Changes to unit capabilities.

(4) Validity of assumptions as they pertain to CBRN defense.

(5) Staff and commander estimates.

(6) CBRN resource allocations.

(7) Increased risks.

(8) Supporting efforts.

For additional information on the operation assessment process, see JP 5-0, Joint Planning.

CHAPTER V
OPERATIONS IN CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR ENVIRONMENTS OF THE FUTURE

1. Anticipating the Future Operational Environment

a. **Introduction.** Over the past twenty years, joint forces have successfully operated against adversaries with limited or no large-scale offensive or defensive CBRN capabilities. The joint force cannot reference these recent conflicts to prepare for future warfare. Adversaries will have a variety of CBRN options to threaten or impact the United States, its allies and partners, and disrupt joint force operations. Joint forces can face exposure to hazards anywhere in the OE and across the competition continuum. Friendly force and civilian exposure could occur from an intentional WMD attack or a conventional attack on chemical and/or biological production, storage, or industrial facilities. Exposure can also occur through industrial or transportation accidents or through releases resulting from attacks on infrastructure. Future conflict with capable adversaries is now the focus of our defense strategies and a more probable scenario.

b. **The Future of CBRN Environment Challenges.** In the future, adversaries will pursue their strategic goals and objectives in an increasingly assertive and aggressive manner by directly challenging the global system of accepted international norms with alternative sets of rules, to include the use of CBRN weapons.

(1) Adversaries attempting to accomplish those goals may pursue the employment of CBRN weapons. Regardless of the limited or unlimited use of CBRN weapons, they will continue to acquire, develop, test, evaluate, and utilize CBRN materials, despite international efforts to curb their production, proliferation, and use. By harnessing a rapidly changing technological environment, emerging scientific research and its associated technologies, adversaries seek to develop low-cost CBRN capabilities. Once acquired, they are likely to join those capabilities with novel new delivery methods including the use of drone swarms, hypersonic weapons, and directed-energy weapons.

(2) The likelihood of adversaries using CBRN materials in future attacks will increase. Adversaries may target toxic industrial material sites and the results can be catastrophic. Future attacks will cause the death, injury, or illness of massive numbers of military and civilian personnel. Casualties may include significant physiological and psychological impacts that can overburden medical facilities for generations. Future attacks can also devastate and contaminate large areas, making terrain unavailable for extended periods.

(3) Left unaddressed, advancements in CBRN technologies increase the threats, hazards, and risks facing joint forces, allies, and partners across the competition continuum. Therefore, JFCs and their staffs will need to remain proficient in current CBRN defense doctrine. They will have to maintain flexibility to adapt as both friendly and adversary capabilities evolve.

2. Chemical, Biological, Radiological, and Nuclear Solutions in the Future Operational Environment

For survival, all leaders need to anticipate future CBRN threats, build and maintain situational awareness, and protect the force while maintaining operational tempo. JFCs will have to disseminate vital information rapidly and securely to make effective decisions. No longer can the joint force rely upon annual visits to the gas chamber and mask confidence tasks for individuals. JFCs can pursue non-materiel solutions immediately and anticipate materiel solutions with advancements in technology in the future.

a. **Non-Materiel Solutions.** JFCs leverage non-material solutions and provide timely, flexible, and relevant capabilities. These solutions will enable JFCs to rapidly adapt operations based upon CBRN threats and adversary doctrine. CBRN threats and hazards will increase as a key consideration of any future OE. Commanders and staffs will need to recognize the growing threat and take appropriate countermeasures. The JFC must continually evaluate how changes in the threat impact CBRN planning considerations and emerging requirements. To respond accordingly, commanders should:

(1) Integrate early warning capabilities across their OAs to enhance overall protection. IEW assists the JFC and staff in developing situational awareness of threats and provide early warning of hazards and creates a framework that supports the commander's decision making. JFCs will need to identify friendly force sensors and platforms (both CBRN and non-CBRN). These sensors can contribute to CBRN awareness and understanding, increase warning time, and provide an integrated and layered CBRN defense posture. When combined with other early warning systems, chemical-biological IEW provides joint forces with enhanced understanding of the CBRN influence on the OE, informs decisions, and strengthens C2. This permits the force to retain freedom of action and generate combat power across all domains by informing hazard mitigation and force protection activities while operating in CBRN saturated or threatened environments.

(2) Monitor the rapid advances in dual-use technology, bioinformatics, synthetic biology, nanotechnology, and genome editing. All of these advances complicate the detection, attribution, and treatment of casualties.

(3) Seek opportunities to assist and develop allied and partner CWMD and CBRN defense capabilities and capacity. JFCs combine all available resources for multiple joint all-domain operations in the same AOR.

(4) Integrate WMD and other CBRN objectives into exercise scenarios and heighten the preparedness of the joint force by including CBRN defense in appropriate training and exercises commensurate with the future threat.

b. **Materiel Solutions.** JFCs must rapidly integrate available materiel solutions and those under development to counter advancements in threat capabilities.

(1) **CBRNWRS.** JFCs should integrate CBRNWRS into a broader IEW system, designed to process and promulgate the CBRN information received and provide commanders and staffs with enhanced decision-making tools. The joint force can use CBRNWRS and leverage near real-time integrated and all-domain prediction, warning, and reporting that is interoperable with allies, partners, and civilian governments and fully compatible with C2 common operating platforms.

(2) **Detection, Identification, Source, and Monitoring.** JFCs will need to develop relevant doctrine and required training to incorporate effectively new materiel solutions. JFCs will need to provide faster and more accurate detection, identification. Moreover, they will have to have better source locating and monitoring of low concentrations of CBRN agents from stand-off distance over complex terrain. JFCs detect, identify, source, and monitor at all echelons of command to avoid contamination or exposure and ensure freedom of movement. To retain the initiative, JFCs will need to detect and identify CBRN threats before adversaries employ them. Identification of hazards pre-usage ensures commanders avoid contamination and exposure and retain freedom of maneuver in the expanding OE. Through source intelligence and monitoring, JFCs can conduct rapid concepts of operations development through joint all-domain operations execution for threat elimination.

(3) **Protection.** At its core, JFCs require effective CBRN protective measures to render adversarial threats ineffective, thereby deterring the likelihood of use. Current CBRN protective capabilities are burdensome and restrictive to individuals and organizations. Additionally, many of these assets are reaching the end of their functional shelf life and need replacement with more modern protective functionality. Commanders need to rapidly develop the training and doctrine to use future protection solutions that will reduce the burden on the individual and the joint force.

(4**) Mitigation and Decontamination.** The joint force must leverage technological advances, enhance current hazard mitigation capabilities, and continue to develop new mitigation efforts to counter evolving threats. The ability to decontaminate personnel and equipment, and effectively reconstitute the joint force is a crucial future capability. JFCs must rapidly mitigate hazards, retain operational tempo, and ensure adversaries have no opportunities for effective CBRN weapons employment.

(5) **Medical.** The joint force must incorporate advancements in prophylaxis, diagnostics, therapeutics, and CBRN medical countermeasures into training and doctrine to enhance the joint forces' ability to operate effectively in CBRN environments.

(6) **Artificial Intelligence.** Artificial intelligence, machine learning, and other technological advances will continue to impact the joint force, adversaries, and future operating environments. JFCs and their staffs must leverage these advancements to provide increased capability. These advancements propel hazard prediction, warning and reporting, protection, contamination mitigation, and other CBRN capability areas. It remains unseen the extent to which artificial intelligence and similar efforts can support

and evolve CBRN defense, but JFCs must remain open to these opportunities before our adversaries.

3. Conclusion

JFCs must anticipate and prepare to conduct joint operations in a CBRN environment. The evolving character of armed conflict, the political and societal complexities of the modern world, and technological advances all combine to make for a very uncertain future. The joint force must continue to rely upon and maintain high levels of proficiency in conducting operations in CBRN environments, while continually looking for new capabilities, both materiel and non-materiel, to enhance their ability to prevail under CBRN conditions against a capable adversary.

APPENDIX A
CHEMICAL HAZARD CONSIDERATIONS

1. General

Exposure to toxic chemicals can significantly influence the OPTEMPO and sustainment of forces. This appendix presents a brief overview of chemical agents and TICs and their effects.

2. Technical Aspects

a. Chemical Agents. Traditional chemical agents include agents in the categories of nerve, choking, blood, blister, and incapacitating. Figure A-1 indicates individual symptoms and effects, rate of action, and how chemical agents are normally disseminated. Figure A-2 provides this information on additional chemicals of military significance (including NTAs). The terms persistent and nonpersistent generally describe the time an agent remains in an area. Persistent chemical agents present contamination hazards for unprotected personnel for more than 24 hours to several days or weeks. Conversely, a nonpersistent agent normally dissipates or loses its ability to cause casualties to unprotected personnel after considerably less time. The effects on personnel exposed to these hazards may be immediate or delayed.

(1) Chemical warfare agents do not depend upon explosive force to achieve an objective; rather their unique properties are designed to kill or injure an enemy or deny unhindered use of a particular area of terrain. A chemical agent can also be used against agriculture and livestock to promote hunger or economic misfortune in a target population.

(2) Chemical warfare agents should not be confused with military chemical compounds or nonlethal weapons. Examples include obscurants. Defoliants are used to quickly kill vegetation and deny use for cover and concealment.

(3) Fourth generation agents (FGAs), also known as Novichoks or A-series, are organophosporus nerve agents developed by the Soviet Union in the early 1970s. FGAs have characteristics similar to other nerve agents, but pose physical, chemical, and toxicological properties that present unique challenges for CBRN defense operations. FGAs have low volatility and are more persistent than other nerve agents. The low volatility of FGAs create detection challenges, and these FGAs pose a significant contamination hazard.

(4) Pharmaceutical-based agents are compounds that are derived from pharmaceuticals or from pharmaceutical research. These compounds may include, but are not limited to, those that affect the central nervous system (such as anesthetics, sedatives, and analgesics). These compounds can produce acute physiological or mental effects and can impair an individual's ability to function. Some of these agents can be lethal in low doses in the absence of medical treatment and pose a hazard if exposed.

Chemical Warfare Agent Categories

Types	Symptoms	Effects	Rate of Action	Release Form
Nerve (Examples: Sarin, Soman,VX, FGAs)	• Difficulty breathing • Sweating • Drooling • Nausea • Vomiting • Convulsions • Dimming of vision • Headache • (Symptoms usually develop quickly)	• Incapacitates at low concentrations • Death at high concentrations	• Very rapid by inhalation or through the eyes • Slower through the skin	• Aerosol • Vapor • Liquid
Blood (Examples: Arsine, cyanogen chloride, hydrogen cyanide)	• Difficulty breathing • Coma	• Interference with respiration at cellular level or by interfering with oxygen transport	• Rapid	• Aerosol • Vapor
Choking (Example: phosgene)	• Difficulty breathing • Irritation to nose, larynx, trachea, bronchi	• Shortness of breath • Tightness in chest • Fluid build-up in lungs	• Full effect may be delayed up to 72 hours after exposure	• Vapor • Liquid
Blister (Examples: mustard, lewisite)	• Symptoms range from immediate to delayed (agent dependent) • Searing of eyes • Stinging of skin • Powerful irritation of eyes, nose, and skin	• Blisters skin and respiratory tract • Can cause temporary blindness • Some sting and wells on the skin	• Blisters from mustard may appear several hours after exposure • Lewisite causes prompt burning redness within 30 minutes; blister on first and second days • Phosgene oxime causes immediate intense pain	• Liquid • Particulate

Legend

FGA fourth generation agent VX nerve agent

Figure A-1. Chemical Warfare Agent Categories

Additional Chemicals of Military Significance

Types	Symptoms	Effects	Rate of Action	Release Form
Riot Control Agents (Example: CS)	• Tear-producing • Sensory irritation	• Incapacitates	• Rapid onset of effects • Brief duration	
Other (Examples: opioids, fentanyl derivatives)	• Dizziness • Sleepiness • Miosis • Vomiting coma	• Incapacitates	• Rapid by inhalation • Dermal exposure results in absorption over hours to days	• Liquid • Aerosol • Particles • Crystalline powder

Legend

CS O-chlorobenzyidene malononitrile

Figure A-2. Additional Chemicals of Military Significance

b. Adversaries often seek to employ chemical agents under favorable weather conditions (wind, air stability, temperature, humidity, and precipitation) to increase their effectiveness, but these weapons could be used at any time.

c. Adversaries may choose to deliver agents upwind of targets; in which case, stable or neutral conditions with low to medium winds of 5-13 kilometers per hour are the most favorable conditions. Marked turbulence, winds above 13 kilometers per hour, moderate to heavy rain, or an air stability category of “unstable” result in unfavorable conditions for chemical clouds. However, the adversary may be able to leverage these factors, or the flow of above-ground and underground water, to effectively employ a persistent agent to contaminate water supplies or deny or clear terrain and material.

d. Most weather conditions do not affect the quantity of munitions needed for effective, initial liquid contamination. Once munitions have been delivered, however, weather conditions can impact the agent’s effectiveness, duration, and dispersion throughout the environment.

e. The National Countering Weapons of Mass Destruction Technical Reachback Enterprise, facilitated by the Defense Threat Reduction Agency (DTRA), can help to identify further information on the impact of the environment on chemical agent dispersion (see Appendix G, “Technical Chemical, Biological, Radiological, and Nuclear Forces,” paragraph 7.g., for DTRA Joint Operations Center contact information).

3. Toxic Industrial Chemicals

a. US forces frequently operate in environments in which TICs are present. A number of these chemicals could interfere in a significant manner across the competition continuum. Most TICs of immediate concern are released as vapors. These vapors exhibit the same dissemination characteristics as chemical warfare agents. The vapors tend to remain concentrated in natural low-lying areas such as valleys, ravines, or man-made underground structures downwind from the release point. High concentrations may remain in buildings, forests, or areas with low air circulation. Explosions may spread liquid hazards and vapors may condense to liquids in cold air.

b. Figure A-3 identifies recommended isolation and protective action distances associated with accidental releases of selected TICs, as recommended by the *Emergency Response Guidebook.* Isolation and protective action distances listed in the *Emergency*

Industrial Chemical Site Minimum Downwind Hazard (Sample)

	Small Release (< 55 Gallon Drum)			Large Release (> 55 Gallons or Multiple Small Releases)		
Chemical*	Isolate All Directions (Meters)	Protect Downwind (Kilometers) Day	Protect Downwind (Kilometers) Night	Isolate All Directions (Meters)	Protect Downwind (Kilometers) Day	Protect Downwind (Kilometers) Night
Ammonia	60	0.2	0.2	120	1.2	4.4
Chlorine	60	0.4	2.4	480	2.4	7.4
Nitric Acid	60	0.2	0.2	120	1.2	2.4
Phosgene	180	1.8	8.2	1600	6.6	21+
Sulfuric Acid	120	0.8	2.0	660	5	13
Hydrochloric Acid	As an immediate precautionary measure, isolate release in all directions for at least 50 meters for liquids and at least 25 meters for solids.					
Petrochemicals						
Phosphoric Acid						

* Samples only. See the current version of the *Emergency Response Guidebook* for additional information.

Figure A-3. Industrial Chemical Site Minimum Downwind Hazard (Sample)

Response Guidebook apply to a release of TICs. If the quantity of the TIC released is unknown, the distances for the large spills in the *Emergency Response Guidebook* should be utilized. Release of TICs is most dangerous at night. Generally, the downwind hazard area from a nighttime release is much greater because of cooler temperature and less wind than during the daytime.

Note: Distances in Figure A-3 are worst-case scenarios involving the instantaneous release of the entire contents of a package (e.g., as a result of terrorism, sabotage, or catastrophic accident). Figure A-3 distances were obtained from the United States Department of Transportation *Emergency Response Guidebook*. These planning factors are adjusted based on the commander's decisions, on-ground understanding, and overall acceptable risks.

c. The most important action in case of an industrial chemical release is **immediate evacuation from the hazard's path.** The greatest risk from a large-scale toxic chemical release occurs when personnel are unable to escape the immediate area and are overcome by vapors or blast effects. **Respirators (e.g., military-issued protective masks) and other protective equipment, including protective clothing, may provide only limited protection against TICs.** However, unless sufficient information indicates otherwise, issued protective equipment should be used during the immediate evacuation from the hazard area if more appropriate protective equipment is not available.

d. In planning for operations in areas that might include TICs, commanders at all levels should include consideration of these potential hazards as part of the JIPOE process. These hazards could occur from deliberate or accidental release from industrial sites, as well as storage and transport containers. Non-state actors have used IEDs to disperse TICs and other adversaries could be tempted to do the same. Particular emphasis should be placed on those TICs that produce acute effects when inhaled or that produce large amounts of toxic vapor when spilled in water. The findings from a comprehensive TIC assessment provide the risks presented by TICs in an OE.

For detailed information on these and other TIC hazards, see the National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards, *the* US Department of Transportation Emergency Response Guide, *and the United States National Library of Medicine Toxicology Data Network.*

e. NTAs are chemicals and biochemicals researched or developed with potential application or intent as chemical warfare agents but which do not fall in the category of traditional chemical agents per the Chemical Weapons Convention. NTAs differ from the traditional blister and nerve agents on which the United States previously focused its defensive efforts. There are multiple categories of NTAs, each with its own set of distinguishing characteristics.

For more information on NTAs and their characteristics, planning considerations, and mitigation, see Appendix E, "(U) Nontraditional Agent Hazard Considerations," and TM 3-11.91/MCRP 10-10E.4/NTRP 3-11.32/AFTTP 3-2.55, (U) Chemical, Biological, Radiological, and Nuclear Threats and Hazards.

APPENDIX B
BIOLOGICAL HAZARD CONSIDERATIONS

1. General

Militarily significant characteristics of biological hazards to operations include a normally vulnerable target population, contagious or toxic agents with highly lethal or incapacitating properties, agent availability or adaptability for scaled-up production, agent stability, and agent suitability for mass dispersion. Limiting factors include biological properties (e.g., virulence), environmental factors (e.g., ultraviolet light causing rapid decay), and dissemination methods (e.g., wet versus dry aerosol).

2. Technical Aspects

a. Biological agents are microorganisms capable of causing disease in humans, animals, and plants. Biological hazards are organisms, or substances derived from organisms, that pose a threat to human, plant, or animal health. These hazards include microorganisms, viruses, or toxins (from a biological source). Pathogens are disease-producing microorganisms (for example, bacteria, viruses, rickettsia, prions) that directly attack human, plant, or animal tissue and biological processes. Pathogens are further divided into noncontagious or contagious. When biological hazards are contagious, planning needs to account for possible ROM and evacuations. Toxins are nonliving, poisonous substances that are produced naturally by living organisms (e.g., plants, animals, insects, bacteria, fungi) but may also be synthetically manufactured. These hazards can originate from sources such as medical waste and biological environmental samples or clinical specimens. Advances in biotechnology, genetic engineering, and natural mutation may facilitate the development or emergence of deadlier biological agents. Biological warfare is the employment of biological agents to produce casualties in personnel, animals, and plants; or to contaminate materiel. Figure B-1 provides a list of selected biological agents and their disease characteristics.

(1) The ability to modify microbial agents at a molecular (gene) level has existed since the 1960s, when new genetic engineering techniques were introduced, but the process tended to be slow and unpredictable. With today's techniques, often referred to as synthetic biology, infectious organisms can be modified to become more infectious and resistant to current prophylaxis and treatment options or to exhibit novel disease characteristics. The current level of sophistication for many biological agents is low, but there is enormous potential—based on advances in modern molecular biology and drug delivery technology—for making more sophisticated agents. Biological agents may emerge in two likely categories: man-made manipulations of classic biological agents and newly discovered or emerging infectious diseases. An example of a recent new pathogen (though not necessarily an ideal biological agent) is *Streptococcus pneumoniae* S23F, a naturally occurring strain of bacteria resistant to at least six of the more commonly used antibiotics.

Pathogens, Viruses, and Toxins of Military Significance

Disease (Etiological Agent)	Exposure Routes	Untreated Mortality (%)	Incubation Period	Medical Treatment	Communicability (Human to Human)
Bacteria and Rickettsia					
Anthrax (*Bacillus anthracis* (spores))	I, C, In	I: ≥ 99 C: 5-20 In: 25-75	1-6 days	Vaccine Antibiotics	No
Plague (*Yersinia pestis*)	I, V	I: ≥ 99 V: 60	1-6 days	Antibiotics	High
Q Fever (*Coxiella burnetii*)	I, C	< 1	2-10 days	Antibiotics Investigative vaccine	No
Tularemia (*Francisella tularensis*)	I, C, V, In	I: 30-60 C,V,In: 10-25	3-5 days (1-21 days)	Antibiotics Investigative vaccine	No
Viruses					
Smallpox (Variola major)	I	30	7-17 days	Vaccine	High
Viral Equine Encephalitis					
Venezuelan Eastern Western	I, V	I: 35, V: 10 I: >75, V: 50-75 I: 40, V: 10	2-6 days 5-15 days 4-10 days	Investigative vaccine Antiviral drugs	No
Viral Hemorrhagic Fever					
Ebola Marburg Lassa Crimean-Congo	I, C. V	50 25-90 15-50 10-40	2-21 days 5-10 days 6-21 days 5-6 days	Investigative vaccine Antiviral drugs	Moderate Moderate Moderate Low
Zika Virus Disease (Zika Virus)	V,C	<1	3-12 days	Supportive Care	Low (body fluids)
Toxins					
Botulism (*Botulinum* neurotoxin)	I, In	I: >60 In: 10-50	I: 6-36 hours In: 18-36 hours	Antitoxin	No
Ricin Intoxication (ricin toxin from *Ricinus communis*)	I, In	I: >50 In: < 30	I: 5-6 hours In: 12-36 hours	Supportive Care	No
SEB Intoxication (*Staphylococcal* Enterotoxin B)	I, C, In	< 1	1-24 hours	Supportive Care	No
T2 Mycotoxin Intoxication (*Trichothecene* Mycotoxin)	I, C, In	10-60	Minutes-hours	Supportive Care	No (dermal transfer)

NOTE: A vector refers to an arthropod or mammal that carries and transmits a pathogen.

Legend

C cutaneous
I inhalation
In ingestion
V vector

Figure B-1. Pathogens, Viruses, and Toxins of Military Significance

(2) The types of modified biological agents that could potentially be produced through genetic engineering methodologies are listed below. Each of these techniques seeks to capitalize on the extreme lethality, virulence, or infectivity of biological agents and exploit this potential by developing methods to deliver agents more efficiently and to gain control of the agent on the battlefield.

(a) Benign microorganisms genetically altered to produce a toxin or bioregulator (naturally occurring organic compounds that regulate diverse cellular processes in multiple organ systems, such as heart rate).

(b) Microorganisms resistant to antibiotics, standard vaccines, antivirals, and therapeutics.

(c) Microorganisms with enhanced aerosol and environmental stability.

(d) Microorganisms able to defeat standard detection, identification, and diagnostic methods.

(e) Microorganisms with enhanced virulence or pathogenicity.

(f) Combinations of the above types with improved delivery systems.

For further information on developments and trends in modifying microorganisms and synthetic biology capabilities and proliferation see JP 3-40, Joint Countering Weapons of Mass Destruction.

b. **TIBs.** TIBs include infectious agents and other biological hazards. Their risk can be direct, through infection, or indirect, through damage to the environment. TIBs are often generated as infectious waste, such as on sharp-edged medical instruments commonly known as “sharps” (e.g., needles, syringes, and lancets), material contaminated by bodily fluids, and as biological clinical specimens (e.g., biopsies or diseases for research).

3. Operational Considerations

a. **Dissemination.** Biological agents may be dispersed or deposited as aerosols, liquid droplets, or dry powders. In general, agents dispersed as dry powder are more viable than those dispersed as wet aerosols. Biological agents can also be transmitted directly by arthropod vectors or by an infected individual. An arthropod is an invertebrate animal having an exoskeleton. Intentionally infected arthropods are useful vectors for penetrating the skin.

b. **Persistency.** The longevity of biological agents is greatly dependent on their viability (ability to cause disease). Examples of viability are shown in Figure B-2.

c. **Environmental Conditions.** Environmental conditions may also affect the viability of biological material (see Figure B-3). These conditions include solar (ultraviolet) radiation, relative humidity, wind speed, and temperature gradient. Ultraviolet light decreases the viability of most aerosol disseminated biological agents. However,

Examples of Biological Material Viability

Disease (Etiological Agent)	Likely Dissemination Method	Exposure Route	Infectivity	Untreated Mortality	Environmental Stability
Bacteria and Rickettsia					
Inhalation Anthrax (*Bacillus anthracis* (spores))	• Aerosol	Inhalation	Moderate	High	Very stable
Pneumonic Plague (*Yersinia pestis*)	• Aerosol • Arthropod	Inhalation Bite	High	Very High	Unstable
Q Fever (*Coxiella burnetii*)	• Aerosol • Liquid	Inhalation Ingestion	High	Low	Stable
Tularemia (*Francisella tularensis*)	• Aerosol • Arthropod • Liquid	Inhalation Bite Ingestion	High	Moderate	Stable
Viruses					
Smallpox (*Variola* major)	• Aerosol	Inhalation Dermal	Moderate	High	Stable
Viral Encephalitis (Eastern, Western, and Venezuelan Equine Encephalitis Virus)	• Aerosol	Inhalation	High	• Eastern - High • Western - High • Venezuelan - High	Stable
Viral Hemorrhagic Fever (Ebola, Marburg, Lassa, Crimean-Congo, others)	• Aerosol	Inhalation	High	• Ebola - High • Marburg - Moderate • Lassa - Low • Crimean-Congo - Moderate	Unstable
Toxins					
Botulism (*Botulinum* neurotoxin)	• Aerosol • Liquid	Inhalation Ingestion	Not Applicable	High	Stable
Ricin Intoxication (ricin toxin from *Ricinus communis*)	• Aerosol	Inhalation	Not Applicable	Moderate	Stable
SEB Intoxication (*Staphylococcal* Enterotoxin B)	• Aerosol • Liquid	Inhalation Ingestion	Not Applicable	Low	Stable

Figure B-2. Examples of Biological Material Viability

Weather Effects on Biological Agent Dissemination

	Weather Condition	Biological Warfare Agent Cloud Performance	Operational Considerations
Favorable	Stable or inversion conditions	Agent clouds travel downwind for long distances before they spread laterally. High humidity and light rains generally favor wet agent dissemination.	Agent clouds tend to dissipate uniformly and remain cohesive as they travel downwind. Clouds lie low to the ground and may not rise high enough to cover the tops of buildings and/or other tall objects.
Marginal	Neutral conditions	Agent clouds tend to dissipate quickly.	More agent required for the same results as under stable conditions. Desired results may not be achieved.
Unfavorable	Unstable or lapse conditions	Agent clouds rise rapidly and do not travel downwind any appreciable distance. Cold temperatures affect wet agent dissemination.	Agent clouds tend to break up and become diffused. Little operational benefit from off-target dissemination.

Figure B-3. Weather Effects on Biological Agent Dissemination

encapsulation through man-made processes, natural sporulation, or arthropod vectors may protect biological agents from the impacts of the environment and increase agent viability.

d. **Trigger Events.** With current technology, it is possible a biological attack could occur before local commanders are aware it has taken place. Commanders, in conjunction with their medical staffs, attempt to distinguish between an epidemic of natural origin, a biological attack, or the release of/exposure to TIBs. Trigger events can assist commanders and the medical staff by providing an indication a biological incident is likely to occur, may be occurring, or has occurred and prompt commanders to initiate response measures. Possible triggers signaling a biological event include evidence of atypical disease and death of livestock and populations; reports of suspicious disease clusters; alarming of biological monitoring sensors; intelligence indicators of concerning modes of enemy protective posture, treatment capability, and medical equipment employability; sentinel cases; or rare diseases.

For further description of the roles, responsibilities, and qualifications of medical staff within DoD, see DoDI 6200.03, Public Health Emergency Management (PHEM).

(1) An intelligence warning trigger event occurs when a commander receives convincing information (unanalyzed) or intelligence (analyzed information) indicating a biological incident (naturally occurring, accidental, or intentional) is imminent. Information and intelligence from multiple sources (e.g., the general public, military intelligence, and national intelligence institutions in the HN) can provide advance warning of a biological event.

(2) Weapons trigger events refer to attacks by a weapon system(s), such as missiles, artillery, or observed attacks employing other delivery means, such as an aerosol sprayer device. Where intelligence has assessed a biological weapon capability, it is reasonable to initially react to weapons events as if they could contain biological agents.

(3) A detector alarm trigger event refers to the discovery of a biological event via a positive result from a detection device, such as positive identification of environmental samples (e.g., water, food), indicating a biological agent is present. Detectors are not an absolute method of indicating the presence of biological agents due to the sensitivity threshold limitations of the devices and the possibility of false negatives/positives. Positive results via detector, followed up with laboratory analysis, may permit discovery of a biological hazard prior to the onset of symptoms.

(4) A sentinel casualty/patient trigger refers to the medical community's identification of a biological agent, biomarker, or infectious disease hazard by assessing trends in medical symptoms among personnel or diagnosis of an index case. Response actions based on a sentinel casualty/patient may begin well into the disease progression cycle. This information may be made available via the news media, the Centers for Disease Control and Prevention, the Defense Health Agency Public Health Directorate (i.e., Armed Forces Health Surveillance Division, Defense Centers for Public Health), the World Health Organization, the National Center for Medical Intelligence, or state and local public health departments.

e. **Additional Attack Indicators.** In addition to the trigger events listed in the subparagraphs for 3.d., "Trigger Events," the surrounding environment can also provide indication of a biological attack. Particular attention should be given to the following:

(1) Increased numbers of sick or dead animals, often of different species. Some biological agents are capable of infecting/intoxicating a wide range of hosts.

(2) Unusual entomological effects (dead insects).

(3) Unusual death or wilting of plants in a certain area.

f. **Sources and Requirements for Weaponization.** Very little distinguishes a vaccine or pharmaceutical plant from a biological production facility. Nearly all the equipment, technology, and materials needed for biological agent production are dual use. On a smaller scale, the same type of equipment is found in research facilities and universities as well. However, the means of production is directly tied to the means of dissemination. Far less technical production capability is required to produce a biological agent to disseminate in an improvised weapon, such as an IED or a mailed letter, than it is for a ballistic missile.

4. Biological Defense

Biological defense comprises the methods, plans, and procedures involved in establishing and executing measures to detect, prevent, and mitigate against biological hazards. In striking contrast to protection against chemical, radiological, and nuclear weapons, there exists the potential to minimize the effects of biological agents. The combined use of medical surveillance, identification, medical countermeasures, physical protection, and ROM provides the basis of biological defense.

a. **Medical Surveillance.** In some cases, humans may be the only biodetector. Early clinical findings may be nonspecific or atypical of the natural disease. Medical personnel may be unable to differentiate natural disease from biological attacks. Considerable time may elapse following a biological attack before the extent of the exposure is known. To enable identification of a biological attack, ongoing, systematic collection and analysis of health data are essential. Following a biological attack, the disease pattern may have characteristics that differ from those of a naturally occurring epidemic. The following are examples:

(1) In contrast to naturally occurring epidemics (excluding foodborne outbreaks) in which disease incidence increases over a period of weeks or months, or an area's endemic diseases, which have a persistent and fairly stable number of infections over time, the epidemic curve for most large, artificially induced outbreaks is compressed, peaking within a few hours or days.

(2) In contrast to the peaks and troughs evident in most natural disease outbreaks, a steady and increasing stream of patients may be seen (comparable to that during an accidental food poisoning outbreak).

(3) Epidemiology is the branch of medicine that deals with the study of the causes, distribution, and control of disease in populations. An understanding of disease ecology and epidemiology can be extremely useful in distinguishing natural outbreaks from those induced by a biological attack. For example, diseases that have natural vectors have environmental parameters that predispose to naturally occurring outbreaks. Appearance of disease in the absence of these parameters would be highly suggestive of a biological attack.

(4) The military health system maintains routine disease surveillance and syndromic surveillance in AORs with a high probability of biological attack or endemic encounters; emergence of an atypical pattern mandates immediate notification of higher

authority. The simultaneous appearance of outbreaks in different geographical locations should alert to the possibility of a biological attack. In addition, multiple biological agents may be used simultaneously in a biological attack, or chemical and biological agents may be combined in a single attack to complicate diagnosis.

(5) A large number of casualties within a period of two to three days (suggesting an attack with a microorganism) or within hours (suggesting an attack with a biotoxin) would epidemiologically indicate a massive single source.

(6) An illness type highly unusual for the geographic area (e.g., Venezuelan equine encephalitis in Europe).

(7) An illness occurring in an unnatural epidemiological setting, where environmental parameters are not conducive to natural transmission (e.g., Venezuelan equine encephalitis in the absence of antecedent disease in horses or in the absence of vector mosquitoes).

(8) An unusually high prevalence of respiratory involvement in diseases that, when acquired in nature, generally cause a non-pulmonary syndrome—the signature of aerosol exposure (e.g., inhalational anthrax).

(9) Casualty distribution aligned with recent wind direction.

(10) Lower attack rates among those working indoors, especially in areas with filtered air or closed ventilation systems, than in those exposed outdoors. The reverse is true when the attack is made by using ventilation systems to disseminate biological agents indoors.

(11) Large numbers of rapidly fatal cases, with few recognizable signs and symptoms, resulting from exposure to multiple lethal doses near the dissemination source.

For more information on medical surveillance, refer to JP 4-02, Joint Health Services.

b. **Identification.** Identification of biological agents is essential to determine appropriate operational and medical countermeasure responses that may be taken by the JFC and public health officials.

(1) Presumptive identification of the biological agent in the operational area influences initial responses. Biological agent categories can generally be described as:

(a) Communicable diseases, such as pneumonic plague, smallpox, influenza, and many others, that are able to be transmitted from person to person.

(b) Noncommunicable diseases, such as anthrax, that can contaminate an area and infect personnel but are not able to be transmitted from person to person.

(c) Noncommunicable biological agents, such as toxins and many other bacterial pathogens, that primarily only cause effects in directly exposed personnel.

(2) Field confirmatory identification is obtained using devices/materials/technologies available to specially trained personnel and units in a field environment that includes collection and analysis of samples to substantiate the presence and type of a biological substance at a given location. Field confirmatory identification can be used to prove (or disprove) previous presumptive results. It results in higher confidence levels to support tactical decisions regarding avoidance, protection, and decontamination measures and immediate treatment.

(3) Theater validation identification qualifies a biological sample if using the accepted quality assurance measures. It provides additional critical information to support timely and effective decisions regarding avoidance, protection, decontamination measures, medical prophylaxis, and treatment for affected units and personnel. It can also support preliminary attribution to implicate or support trace analytics for the source of the identified CBRN material.

c. **Medical Countermeasures**

(1) **Immunoprophylaxis**

(a) **Active Immunoprophylaxis.** Vaccination is an important practical means of providing continuous protection against biological hazards prior to, as well as during, hostile actions. Vaccines against a number of potential biological agents are available. Many of these vaccines were developed for the protection of laboratory workers or individuals working where the target diseases are endemic.

1. During a biological agent attack, the number of infectious or toxin units to which an individual is exposed may be greater than in the case of natural exposure. Exposure by inhalation may represent an unnatural route of infection with many biological agents. The efficacy afforded by most vaccines is based on route of exposure and presentation of disease. Vaccines, which are generally considered to be effective under natural circumstances, may not provide a similar degree of protection to individuals exposed to aerosolized or genetically altered agents.

2. An appropriate immunization policy is essential. Vaccines are biological agent-specific and do not provide immediate protection. Not all vaccines can be administered simultaneously; therefore, to prevent the logistic problems caused by in-theater vaccination, prior immunization is essential.

3. If an in-theater vaccination program is required, the possibility of adverse reactions from vaccination and the concomitant degradation of operational efficiency should be taken into account.

(b) **Passive Immunoprophylaxis.** For some biological agents, the only available medical countermeasures might be specific antisera (administering blood serum with protective antibodies). Under certain conditions, passive immunoprophylaxis with immunoglobulin products might be considered. Use may be limited by lack of adequate sources and quantities of material, limited duration of protection, and the risk of serum sickness associated with antisera of animal origin. However, recent scientific advances in products for immunoprophylaxis (for example, human monoclonal antibodies, despeciated equine or ovine antisera) are making this option technically more attractive.

(2) **Chemoprophylaxis**

(a) Chemoprophylaxis using appropriate drugs (e.g., antibacterials, antibiotics, antivirals) may offer additional protection in the event of a biological incident. If an attack may be imminent (i.e., intelligence indicator), or is known to have occurred (i.e., weapon or a sentinel casualty/patient), command-directed chemoprophylaxis would be appropriate for all personnel in the area. However, it is impractical and wasteful to place everyone located in a potential target area on prolonged, routine antimicrobial prophylaxis in the absence of such a threat condition. Chemoprophylaxis/in-theater use of antibiotics or pharmaceuticals may be a Food and Drug Administration off-label use.

(b) For bacterial agents, antibiotics should be administered as soon as possible following exposure. Initiation of chemoprophylaxis during the incubation period is always worthwhile. However, the earlier the antibiotic is given, the greater is the chance of preventing disease. In some cases (e.g., inhalational anthrax), post-exposure vaccination must be given in addition to antibiotics to personnel previously unvaccinated to prevent late onset of disease when antibiotics are withdrawn.

(c) Consideration should be given to the possibility of the interaction between drugs in multi-drug regimens that address the multiple elements of force health protection. Medical personnel should maintain consistent observation of personnel receiving chemoprophylaxis to identify and treat harmful interactions or side effects.

d. **Community Mitigation Measures**. Response to biological threats or hazards may entail community mitigation measures. These are behaviors or actions that communities can take to help slow the spread of a biological threat, to include threat-informed travel restrictions and border health measures, contact tracing, isolation, quarantine, social distancing, handwashing, use of PPE, and other non-pharmaceutical interventions. Depending on the circumstances, the joint force may be providing advice and support to civil authorities in developing these measures or may be required to abide by them when interacting in local communities.

e. **Physical Protection**

(1) **IPE/PPE**

(a) **Respiratory Protection.** Respiratory protection is essential in the presence of any biological inhalation hazard. Currently, fielded protective masks equipped with filters provide a high degree of protection but increase the physiological burden for the force when worn as respiratory protection during missions over extended periods of time spanning weeks to months. Other forms of protection (e.g., self-contained breathing apparatus) are available and may be fielded to meet particular conditions. Surgical masks may be worn as part of a layered approach (i.e., while indoors resting) to reduce the physiological burden of wearing a full-face respirator. Low-grade dust masks or warming layers pulled over the face are not sufficient to protect against aerosol attacks; however, they may help reduce the spread of infections through sneezing, coughing, or contaminated hand contact to the face. Personnel using military or commercial protective equipment (e.g., military protective masks, commercial respirators, military and commercial protective clothing) are required to follow Service-specific IPE/PPE requirements.

(b) **Dermal Protection.** Intact skin provides an excellent barrier against biological agents; however, any skin abrasions or inflammation should be covered. In some instances, it may be necessary to protect the mucous membranes of the eye. IPE clothing employed against CBRN agents protects against skin contamination with biological agents, although standard uniform clothing affords a certain degree of protection against dermal exposure to the surfaces covered.

(c) **Casualties.** Casualties unable to continue wearing IPE in a biological agent-contaminated area should be held or transported using containment measures to protect the casualty against biological agent exposure. Contagious patients should be held or transported using a barrier system to prevent disease transmission.

(2) **COLPRO**

(a) A COLPRO shelter is a dedicated shelter equipped with a CBRN air filtration unit. This shelter provides an overpressure environment to allow medical treatment personnel to work inside with minimal IPE/PPE or without the need for additional IPE/PPE. To maintain COLPRO shelter integrity, contaminated patients, staff, and equipment/materials must be decontaminated prior to entering.

(b) COLPRO is the most effective method for protecting clean patients, medical personnel, and the medical treatment facility during a biological attack or a disease outbreak resulting from an endemic encounter such as Ebola, or an accidental release of an agent. Patients whose illness is thought to be the result of a biological attack or those thought to have a transmissible disease are cared for using barrier protection techniques. The environment within COLPRO may promote cross-infection between casualties and staff and it may be appropriate to care for these patients outside COLPRO.

For more information on individual, patient, and caregiver protection, refer to ATP 4-02.7/MCRP 3-40A.6/NTTP 4-02.7/AFTTP 3-42.3, Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment.

f. **ROM**

(1) ROM refers to controlling the movement of or contact with potentially infected persons to stop the spread of contagious disease. To prevent the spread of an infectious disease or contagious illness, public health authorities use different techniques. ROM (including isolation, and quarantine enforcement actions) is generally within the jurisdiction of the state and local authorities and, when overseas, HN authorities. Enforcement actions by DoD personnel are restricted by the Posse Comitatus Act or DoD policy unless an alternative statutory or constitutional authority exists (e.g., Presidential invocation of the Insurrection Act). In areas outside of the United States, enforcement actions by DoD personnel are conditioned by applicable treaties, agreements, or other arrangements with foreign governments and allied forces. Implementation of these actions at non-US installations and field activities require formal agreements with HN authorities as well as multinational forces.

See DoDI 3025.21, Defense Support of Civilian Law Enforcement Agencies, *for additional guidance on DoD participation in civilian enforcement actions.*

(2) In the case of military personnel, restrictions, isolation, quarantine, or any other measure necessary to prevent or limit transmitting a communicable disease may be implemented. In the case of persons other than military personnel, restrictions may include limiting ingress to, egress from, or movement on a military installation.

(a) Isolation is a form of ROM that refers to the separation of persons who have a specific infectious illness from a healthy population. Isolation allows for the target delivery of specialized medical care to people who are ill, while protecting healthy people from getting sick. Infected people in isolation may be cared for in their homes, in hospitals, or in designated medical treatment facilities. DoDI 6200.03, *Public Health Emergency Management (PHEM) Within the DoD,* addresses requirements for managing the impact of public health emergencies caused by all-hazards incidents.

(b) Quarantine is a second form of ROM that refers to separating and restricting the movement of persons who, while not yet ill and have not shown signs and symptoms of the disease, have been exposed to an infectious agent and therefore may become infectious. Quarantine involves the confinement and active, continued medical surveillance of an individual who is suspected of having been exposed to an infectious agent until determined that they are free of infection. Quarantine is medically very effective in protecting the public from disease.

(c) Other restrictions could be determined based on the potential exposure of members of the Armed Forces of the United States as a result of a directed response to a biological hazard outbreak.

APPENDIX C
RADIOLOGICAL HAZARD CONSIDERATIONS

1. General

a. Radiation is ever-present, and there is a background of natural radiation everywhere in our environment. It comes from space (e.g., cosmic rays), from naturally occurring radioactive materials contained in the earth (e.g., uranium), and is in living things (e.g., potassium-40). The source of radiation may be natural or man-made. Man-made sources are created by processing natural radioactive material or by neutron bombardment or accelerators and include machine-generated radiation. Naturally occurring radioactive sources can complicate detection and quantification of man-made radiation and the interpretation of radiation measurements for identifying and marking a potential hazard area, making radiation risk management challenging. It should also be noted that many common radioactive materials also present a chemical toxicity hazard, which may actually exceed that of the radiation.

b. Radiation hazards may arise from the presence of large amounts of natural radioactivity (high background); unintentional, improper use of radioactive material; intentional use of radioactive material to kill or injure personnel or conduct area denial; or nuclear weapons detonation and fallout. Radiation threats differ from chemical and biological threats because radiation cannot be neutralized or sterilized except by time and is not contagious. Further, exposure to radiation does not require direct physical contact.

c. Radiation should be differentiated from the radioactive material itself. Radiation is the energy emitted in the form of electromagnetic energy or as subatomic particles and, as such, can interact at some distance from the radioactive material itself. Radioactivity is a physical property of energetically unstable atoms. Radioactive material is a substance emitting radiation. A radionuclide is an element that has excess energy, making it unstable (i.e., radioactive); there can be multiple radionuclides (isotopes) for the same element. Each radionuclide has a unique characteristic half-life. Half-life describes the rate at which a specific radioactive material decays or changes from one nuclide to another nuclide that may in turn be radioactive or stable. Half-life can vary from a fraction of a second to many years, but once a material is stable, there is no longer an associated radiation emission.

d. There are many variables that influence the human health impact of radiation exposure. A whole body exposure to penetrating radiation may result in immediate effects if delivered in large amounts over a short period of time; cancer may develop years later or there may be no adverse medical conditions at all. The effects of radiation exposure are usually enhanced if there are other concurrent injuries. There are medical countermeasures and treatments that can be employed to moderate the effects of the radiation exposure.

e. The Services are specifically responsible for establishing radiation safety policy and guidance for handling military radioactive material commodities, such as depleted uranium munitions, and for developing and enforcing exposure standards that protect personnel against external and internal exposure. In the operational area, the commander, in consultation with the staff, is responsible for managing risk for those within the command.

f. There are a variety of instruments at various echelons designed to detect radiation. At the unit level, there are handheld devices (e.g., radiation detection, indication, and computation equipment) and dosimetry. Dosimeters measure exposure to ionizing radiation, at the unit or individual level. Specialized units may have more advanced handheld devices and laboratory-grade equipment. Definitive quantitative measurements of air, water, and soil can be performed at Service laboratories specializing in environmental radiation measurements. Background radiation should always be a consideration in the employment of radiation detection devices.

g. There are several methods to mitigate radiation hazards. The most straightforward and effective way is to avoid areas with radiation levels above normal background level. Radiation hazards should be assessed in the context of all other hazards (e.g., minefields, active engagement with the enemy, chemical or biological hazards). If avoidance is not an option, then time, distance, and shielding should be used to limit exposure. Reduce the time of exposure, maximize the distance between the source and personnel, and utilize shielding material to reduce exposure. Individual protection and COLPRO can be used to preclude skin contamination and internal contamination via inhalation, ingestion, or injection. Although radiation cannot be neutralized, personnel and equipment can be decontaminated by removing radioactive contaminants to limit exposure and potential cross-contamination. Finally, medical countermeasures can be used to limit the internal uptake of radionuclides and enhance the excretion of internal contaminants. Medical treatments are also used to lessen the effects of external exposure.

h. Radiation exposure status (RES) is used to track unit exposure level, while the OEG is the commander's primary administrative control used to limit radiation exposure to personnel for a given mission.

2. The Radiological Hazard

a. **Introduction**

(1) In addition to direct exposure to radiation and fallout from a nuclear detonation, there are many other potential sources of radiation. These sources can be broken down into five broad categories: natural, industrial, agricultural, medical, and military commodities. Toxic industrial radiological refers to any radiological material manufactured, used, transported, stored, and disposed of in industrial, agricultural, medical, or military processes. Radiation is emitted in the form of neutrons, alpha particles, beta particles, gamma rays, or X-rays. Once radioactive material is introduced into the environment, it may be found in air, soil, and water, or as contamination on any object.

(2) Radioactive materials, to include fissile material, may be used by an aggressor in one or more of the following ways: as a nuclear device, a RDD, or as a radiological exposure device.

(3) The health effects of exposure to radiation and radioactive materials can be deterministic or stochastic.

(a) **Deterministic effects** are those in which the severity of the effect increases with dose above some threshold, below which there is no apparent effect, and only happens at relatively high doses. Large doses in a short time period may cause a combination of deterministic effects termed acute radiation syndrome. The higher the dose, the faster these effects occur and the more severe the syndrome.

(b) **Stochastic effects**, also termed nondeterministic, have an indirect cause and effect relationship associated with ionizing radiation and health (e.g., risk of cancer). Unlike deterministic relationships, stochastic effects cannot be relegated to a metric or specific threshold dose. Instead, the only predictable outcome is that as radiation exposure increases, so does the risk of developing cancer or other health risks. Occupational radiation safety programs and regulations are designed to preclude deterministic effects and limit stochastic effects to an acceptable level. Figure C-1 summarizes the overall effects of prompt radiation exposure as a function of dose for healthy, young adults with no other injuries. The threshold for deterministic effects are lower for personnel with combined injuries. Medical intervention can limit some effects and increase survivability.

b. **Sources of Radiation** (see Figure C-2)

(1) Nuclear detonation and fallout.

(2) Natural sources of radiation include those of both terrestrial and cosmic origin. Terrestrial radionuclides found in the Earth's crust include uranium and thorium decay chains, among others. The Earth is exposed to cosmic radiation. These are the main contributors to background radiation, along with worldwide fallout from above ground nuclear weapons testing.

(3) Industrial sources of radiation include cargo inspection systems, industrial X-ray machines, accelerators, sterilizers for food and medical instruments, well hole loggers, and moisture density gauges. Nuclear weapons production and the nuclear fuel cycle, including mining and milling, fuel production, reactor operations, reprocessing, and waste, also fall in this category.

(4) Medical sources of radiation again include machine-generated radiation from medical accelerators, X-ray, and computed tomography machines for diagnosis and treatment of disease and injury.

(5) Military commodities encompass all radioactive materials used in military equipment. There are many radionuclides on or in military equipment. The most common use is as a luminous agent (to make things glow in the dark).

c. **Mechanisms of Radiation Production**

Effects of Prompt Radiation Exposure

Acute Dose Centigray (cGy) Free-in-Air (See Note 1)	Threshold Effects Within 1 Day (See Notes 2, 3)	Probability of Death Within 30 Days	Probability of Nausea/ Vomiting Within 6 Hours	Percentage Expected to Require Hospitalizations	Probability of Death from Excess Cancer (40 Years After Exposure) (See Note 4)
25	None expected	< 1%	< 1%	< 1%	< 1%
75	Mild – Nausea – Vomiting – Headache	< 1%	< 10%	< 1%	1-2%
125	• Lymphocyte count drop • Fever	< 1%	< 25%	< 10%	2-4%
410	• Moderate vomiting • Diarrhea • Fatigue	≥ 50%	75%	100%	10-15%
1000	Performance degraded	See Note 5	100%	100%	See Note 5
3000	Combat ineffective	100%	100%	100%	Not applicable
8000	• Disorientation • Death				

rad = radiation absorbed dose
1 rad = 1 cGy
100 rad = 1 Gray

NOTES:

1. Assumes a low linear energy transfer radiation dose (e.g., X-ray, gamma).
2. The probability of death is without medical treatment and for healthy adults.
3. Burns and/or trauma in combination with radiation injury increases mortality. Personnel with such injuries combined with radiation doses exceeding 100 cGy will likely require prompt medical evaluation. Personnel with combined injuries with doses in excess of 600 cGy are unlikely to survive regardless of medical intervention.
4. US citizens have approximately 41% chance of getting cancer over lifetime, averaging between 37% and 41% based upon race and ethnicity.
5. For every 1 sievert increase in exposure expect a 5% increase in incidence of cancer.

Figure C-1. Effects of Prompt Radiation Exposure

(1) The most commonly encountered means of man-made radiation production is machine generation. In medicine, exposure to radiation occurs during X-ray, computed tomography, and particle-accelerator-related treatments. Machine-generated radiation is also used in industrial X-ray machines and in inspection devices for baggage, cargo, and, most recently, passengers. In research, electron microscopes and X-ray diffraction equipment produce radiation. Machine-generated radiation equipment requires electrical power to produce radiation and is only hazardous when powered and activated, although there may be residual radioactive activation products formed in building materials in the vicinity of high-energy accelerators.

(2) Radioactive material produces radiation by the physical process of radioactive decay. Radioactive decay occurs when an energetically unstable nuclei (parent nuclide)

Commonly Encountered Radionuclides

Radionuclides

Name	Symbol	Source/Use
Potassium-40	K-40	Terrestrial
Phosphorus-32	P-32	Atmospheric
Carbon-14	C-14	Atmospheric
Tritium	H-3	Atmospheric, military
Cobalt-60	Co-60	Industrial, medical, military
Cesium-137	Cs-137	Industrial, military
Iridium-192	Ir-192	Industrial, medical
Uranium	U-234, U-235, and U-238	Industrial
Depleted uranium	U-238	Industrial, military
Plutonium	Pu-238, Pu-239, and Pu-240	Industrial
Radium-226	Ra-226	Industrial, military
Radon-222	Rn-222	Industrial
Iodine-131	I-131	Industrial, medical
Strontium-90	Sr-90	Industrial
Molybdenum-99	Mo-99	Medical
Technetium-99m	Tc-99m	Medical
Xenon-133	Xe-133	Medical
Fluorine-18	F-18	Medical
Thallium-201	Tl-201	Medical
Nickel-63	Ni-63	Military
Americium-241	Am-241	Military
Promethium-147	Pm-147	Military
Thorium-232	Th-232	Military

Figure C-2. Commonly Encountered Radionuclides

emits energy or radiation as it becomes a (progeny) nuclide that may be either radioactive or stable. An example is the isotope of uranium with an atomic mass of 238 (or U-238 commonly found in depleted uranium): U-238 decays into Th-234 [isotope of thorium with an atomic mass of 234] via alpha decay with a half-life of 4.5 billion years. Radioactive material remains a hazard until the material decays into an inconsequential quantity (the rule of thumb is about seven half-lives of the nuclide), although there may be radioactive progeny that also need to be considered during the risk management process. Since decay is a physical process at an atomic scale, it cannot be altered via inactivation or decomposition as can chemical and biological hazards. Further, some radiation types can be a hazard at some distance from the source radioactive material. Decontamination can be done by physically removing exterior radioactive particles, but they remain a hazard in the waste stream. Radioactive material, once internalized, can remain in the body of exposed personnel for the lifetime of the individual or until it decays away. IPE masks and suits help prevent particulate internal exposure via inhalation, ingestion, or absorption through the skin or a wound. However, IPE does not protect against all forms of external radiation exposure. IPE keeps alpha and beta particles from touching an individual; a protective mask (i.e., respirator) protects from inhalation of radioactive material. Neither of these offers protection from gamma or X-ray radiation. Protection is discussed in further detail in following sections.

(3) Radiation may be produced by fission of certain radionuclides, such as U-235 [isotope of uranium with an atomic mass of 235] and Pu-239 [isotope of plutonium with an atomic mass of 239], which are used to make nuclear fuel and nuclear weapons. Fission involves the splitting of atoms into two fission fragments and the emission of radiation in the form of one or more neutrons and gamma rays. Spontaneous fission can occur, but fission is more likely initiated by a neutron being absorbed within the parent nuclide. Fissionable nuclides typically have relatively long half-lives and undergo radioactive decay via alpha decay. Once an atom splits and emits neutrons, the neutrons interact with the surrounding medium. If more fissionable material is present, some of the neutrons may be absorbed and fission more atoms. When this cycle repeats, it is called a chain reaction. Not all fissionable materials can sustain a chain reaction. For example, U-238 atoms can fission with high energy neutrons but cannot sustain a chain reaction. Fissile material is fissionable material that is able to undergo a self-sustaining chain reaction with neutrons of any energy. If a chain reaction occurs, it can potentially lead to a nuclear detonation that releases large amounts of energy. The amount of fissile material in a specific configuration required to generate a chain reaction is called the critical mass. Two initially subcritical masses, when brought together, can emit lethal amounts of radiation and possibly detonate. Separation of subcritical masses is imperative.

d. **Types of Radiation**

(1) Neutrons originate in the nucleus of an atom, have a substantial mass (~1 atomic mass unit), and no charge. They are penetrating (may act at long distances) and have variable health effects depending upon their energy. They are difficult to detect and require specialized equipment not commonly found in the field. Hydrogenous materials, such as water or plastics, make good shielding against neutrons.

(2) Alpha particles are large (~4 atomic mass units), charged (+2), helium nuclei. They are produced by heavy unstable nuclei with too low of a neutron to proton ratio. Because of their relatively large size and positive charge, they have a very short range (a few centimeters in air, a few microns in tissue) and deposit a great amount of energy in a relatively short path length. Alpha particles are difficult to detect in the field due to their short range and limited ability to penetrate the volume of a detector. Alpha particles are easily shielded by a piece of paper or human skin. Therefore, health effects of an alpha exposure occur only when the alpha emitters are inhaled, ingested, injected, or enter the

body through an open wound or the lens of the eyes. Alpha particles inside the body can be exceedingly dangerous.

(3) Beta particles are electrons or positrons that are ejected from the nucleus of an unstable atom. Positrons are subatomic particles with the same mass as an electron but positively charged. Beta particles have a mass of about 0.0005 atomic mass units and a charge of -1 for electrons and +1 for positrons. They deposit much less energy per unit path length than an alpha particle and have greater range (meters in air, millimeters in tissue). Typically, they are relatively easy to detect with commonly fielded, handheld, radiation detection equipment. There are notable exceptions to this general rule: both carbon-14 and tritium are difficult to detect due to the very low energy of the beta particle, illustrating that just because radiation is not detected, does not mean there is not any present. Note that skin contamination with beta emitters can cause burns. Plexiglas or aluminum are good shielding materials for beta emitters.

(4) Gamma and X-rays are electromagnetic energy, have no charge, and are very penetrating. However, they have different points of origin. Gamma rays originate in the nucleus of the atom, while X-rays originate from an electron change in energy. Their energy spectra overlap, but X-rays are generally lower in energy than gamma rays. They are easy to detect with handheld, field-detection systems. Most radionuclides have some relatively abundant gamma or X-ray associated with their alpha or beta decay, allowing them to be detected with typical handheld instrumentation. Dense materials such as steel or lead are typically used as shielding for gamma and X-rays.

e. **Employment.** The previous discussion has outlined radiological sources that are in legitimate use throughout the world, but there are means to use these sources as weapons. Radiological material can be offensively employed in nuclear weapons, radiological exposure devices, and RDDs. Attacking and destroying facilities where radioactive material is used or stored (e.g., nuclear reactors) may lead to distribution of radioactive material in the environment. The efficacy of radiological weapons, other than nuclear weapons, at inflicting casualties, is not high. They are, however, well suited to creating fear and as area denial weapons.

(1) A relatively small number of countries have nuclear weapons capability because they are technically difficult and expensive to produce. Nuclear devices produced by nuclear capable countries can be difficult to detonate without proper equipment and security codes. If used at the optimum height of burst, a nuclear weapon would generate ionizing radiation and an EMP, causing extensive damage to electronic equipment, conventional damage, and injury but, likely, very little fallout.

(2) A radiological exposure device is a penetrating radiation source (gamma or neutron) that is placed or buried where people may be exposed to the radiation emitted. A radiological exposure device is relatively easily employed, but obtaining the material might be difficult. If a relatively strong source of penetrating radiation could be obtained, it could be emplaced in a public location, such as a park or public building, in such a way as to maximize the probability and time of exposure to those nearby. If the source were big

enough and the time of exposure long enough, exposure could lead to acute effects such as nausea, diarrhea, erythema (reddening of the skin), and even clinical illness and death.

(3) A RDD uses a conventional explosive to disseminate radioactive material. The explosive itself would likely cause most of the direct damage and injury, but the radioactive contamination may deny use of the area and complicate incident management and health services support. Additionally, any device capable of spreading material could be used as an RDD, without a conventional explosive. Mitigation of the effects of the contamination would consume significant resources. Additionally, it may not be routine for seemingly conventional attack responses, such as IEDs or other improvised weapon attacks, to utilize radiation detection equipment to confirm the presence of radioactive material, delaying recognition of the RDD event and further complicating effective response and risk management. The radiation itself may not pose an immediate health threat, but contamination control measures and protective measures (IPE, PPE) should be implemented to reduce risk of future health implications (see Figure C-1).

(4) Nuclear power plants and their attendant reactors represent potential fixed strategic targets for adversaries. The radiation release from their damage or destruction can present a regional or multi-national hazard, and their denial of function can lead to substantial power loss for large segments of the local population. As a result of these potential effects, even the simple credible threat of adversary actions against nuclear reactors can create fear or panic in local populations or risk escalating or expanding international involvement, presenting informational or strategic challenges for the JFC. When present in the OE, JFCs should assess the vulnerability of nuclear facilities and plan for potential adversary threats against them, including conventional, asymmetric or cyberspace threats, and informational aspects.

3. Radiological Threat Management

a. **Responsibilities.** The commander manages risk on behalf of all personnel under the commander's authority. It is DoD policy to reduce exposure to ionizing radiation associated with DoD operations to a level as low as reasonably achievable (ALARA) consistent with operational risk management. Complying with the principle of ALARA is done in the context of managing risk from all sources. Commanders balance risk management with the requirement of completing the military mission.

(1) **Operational Commanders**

(a) Set the OEG.

(b) Establish guidance for the use of radioprotectants; consult with command surgeon.

(c) Review radiological risk throughout mission; revise guidance if necessary.

(2) **Staffs**

(a) Conduct radiological risk management.

(b) Provide risk estimate and mitigation recommendations to the commander.

(c) Implement medical surveillance program.

(d) Recommend guidance for the use of radioprotectants and radiotherapeutics.

(e) Collect/archive cumulative dose information.

(f) Prepare radiological risk updates as mission progresses; recommend additional mitigation measures or revised guidance if circumstances dictate.

b. **Detection and Measurement**

(1) **Handheld Radiation Detection Equipment**

(a) Only in very peculiar circumstances can an individual sense radiation without the aid of some detection device, and there are no universal radiation detection systems that are appropriate for every type of radiation detection scenario. Each system has its advantages and disadvantages. The selection of the appropriate radiation detection system depends upon many variables, including the type of radiation (alpha, beta, gamma, neutron) that is of interest, the environmental media or circumstances (air, water, soil, surface, volume, or ambient), the type of measurement that is needed (removable contamination, cumulative dose, dose rate, exposure, exposure rate, or counts per minute), and the need to determine radionuclide identity. Detection equipment generally provides indication well before radiation levels present a health hazard.

A negative response on a given piece of radiation detection equipment does not necessarily indicate radiation or radioactive materials are not present. Not all detectors are capable of detecting and measuring all types of radiation; therefore, the detection limits of each type of detector are considered.

(b) The most commonly available and most useful radiation detection instruments are capable of measuring ambient and surface dose and dose rate from gamma and beta emitting nuclides. CBRN specialists, bioenvironmental engineers, industrial hygiene specialists, and health physicists are able to detect and measure gamma rays, and alpha and beta particles using specialized probes. Available through a radiation safety officer, there may be specialized instruments in theater that can provide nuclide identification capability for gamma-emitting nuclides. Some dosimeters are neutron sensitive.

(2) **Mobile Map-on-the-Move Systems.** These aerial and ground systems autonomously survey a radiological hazard and produces a map which is ready for dissemination to the joint force. This enables vehicle crews to remain in vehicle and quickly bypass the threat. These systems can significantly reduce survey time and warfighter exposure.

(3) **Backpack Detection Equipment.** The backpack detectors reduce time to detect a radiological source and increase standoff distances for personnel, reducing exposure.

(4) **Networkable Sensors.** Multifunctional, smart, networkable detectors can be handheld, used with unmanned systems, or left unattended. These sensors are adaptable to the OE and, with their networking and when linked to situational awareness tools, enable increased awareness of both location and identity of the hazard. Networkable detectors improve data sharing and decision-making across the joint force.

(5) **Personnel Radiation Dosimetry.** Field dosimetry systems are deployed with those units that have a requirement to track the radiation dose of their personnel. A difference should be noted between real-time reading dosimeters (such as an electronic personal dosimeter or a color-changing dosimeter) and those that require separate equipment and extra time to read. An unforeseen requirement for dosimetry may arise that necessitates establishing a dosimetry program or augmenting the program already in place. In this eventuality, the following Service agencies can be contacted for guidance and support:

(a) US Army Dosimetry Center
ATTN: AMSAM-TMD-SD, Building 5417
Redstone Arsenal, AL 35898-5000

(b) US Air Force Radiation Dosimetry Laboratory
2510 5th Street, Area B, Building 0840
Wright-Patterson Air Force Base, OH 45433-7212

(c) Naval Dosimetry Center
Walter Reed National Military Medical Center
8901 Wisconsin Avenue
Bethesda, MD 20889-5614

(6) **Laboratory Grade Capabilities.** Laboratory capability in a field environment is likely to be very limited or nonexistent. This level of measurement is usually reserved for environmental samples that are taken in the field and then sent to a laboratory outside the theater of operations. This capability can be accessed through the following contacts:

(a) Defense Centers for Public Health-Aberdeen Laboratory Sciences Portfolio
ATTN: MCHB-TS-L
5158 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5403

(b) Defense Centers for Public Health-Dayton
2510 5th Street, Building 840
Wright-Patterson Air Force Base, OH 45433-7913

(c) Environmental, Safety, and Occupational Health (ESOH) Service Center
esoh.service.center@us.af.mil

(d) Defense Centers for Public Health-Portsmouth

Field radiation detection, measurement, and survey techniques are detailed in ATP 3-11.37/MCRP 10-10E.7/NTTP 3-11.29/AFTTP 3-2.44, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance.

c. **Radiological Contamination Mitigation**

(1) **Principles of Radiation Protection**

(a) If radiation is encountered and the mission requires potential exposure, radiation protection is achieved through time, distance, and shielding. Minimizing time of exposure in an elevated radiation environment minimizes dose. Mission permitting, practice tasks that have to be performed in a radiological environment before execution so they can be performed more quickly. Rotate personnel in and out of the radiological environment so no single individual is excessively exposed. Sometimes forgoing the use of IPE that might slow operations can shorten time of exposure and minimize dose.

(b) Maximizing personnel distance from the source minimizes dose. Distance has an inverse square relationship to radiation exposure or dose, meaning that if the distance from the source is increased by a factor of X, the dose is decreased by a factor of X^2 (e.g., double the distance, quarter the dose). Individuals should also be aware of their location relative to the source so they can position themselves at the maximum distance from the source, consistent with mission accomplishment. If the source is contamination on the ground and is fairly uniformly distributed, standing or sitting above the ground in a vehicle or elevated platform minimizes dose by providing distance and shielding.

(c) Shielding is simply placing material between personnel and a source. The reduction of the dose depends on the type of radiation being emitted and the shielding material type, density, and thickness. Thicker is always better but may be limited by weight and availability. Lead and other dense materials work well for gamma and X-ray emitters. Lower density means greater thickness is required for the same shielding value. Lower-density material such as Plexiglas or aluminum should be used to shield against beta emitters. Beta interaction with high-density materials like lead can lead to significant X-ray production, possibly increasing dose. Neutrons can be shielded with materials that have a lot of hydrogen atoms, like plastics and water. Generally, it is not necessary to shield for alpha particles. Concrete, earth, and sandbags can work well as field-expedient shielding material for all sources. In addition, vehicles provide shielding, with armored vehicles generally providing more shielding than light vehicles. Note that IPE does not provide shielding for the most part, but it can limit contamination and internal uptake of radioactive material, thereby limiting dose. Figure C-3 depicts effective shielding materials for the different types of radiation.

(2) **Avoidance.** Avoiding sources of radiation is obviously the most effective means of limiting radiation risk but may increase other risks (e.g., choosing to go around a contaminated area might subject a unit to the physical risk of a mine field or increased likelihood of ambush).

(3) **Personal Protection and COLPRO.** Utilization of IPE and COLPRO can control contamination and limit internalization of radioactive material, which is particularly important for alpha emitters. Some COLPRO systems may also have some shielding value, although this is not the case with IPE.

(4) **Decontamination.** Radioactive contamination is generally associated with particulates, although there are some materials that are found as gasses or vapors. No special decontamination solution is required for radioactive material, since the hazard cannot be reduced by chemical or physical destruction. Waste material generated as a result of decontamination should be controlled and disposed of in accordance with appropriate command TTP or HN disposal procedures.

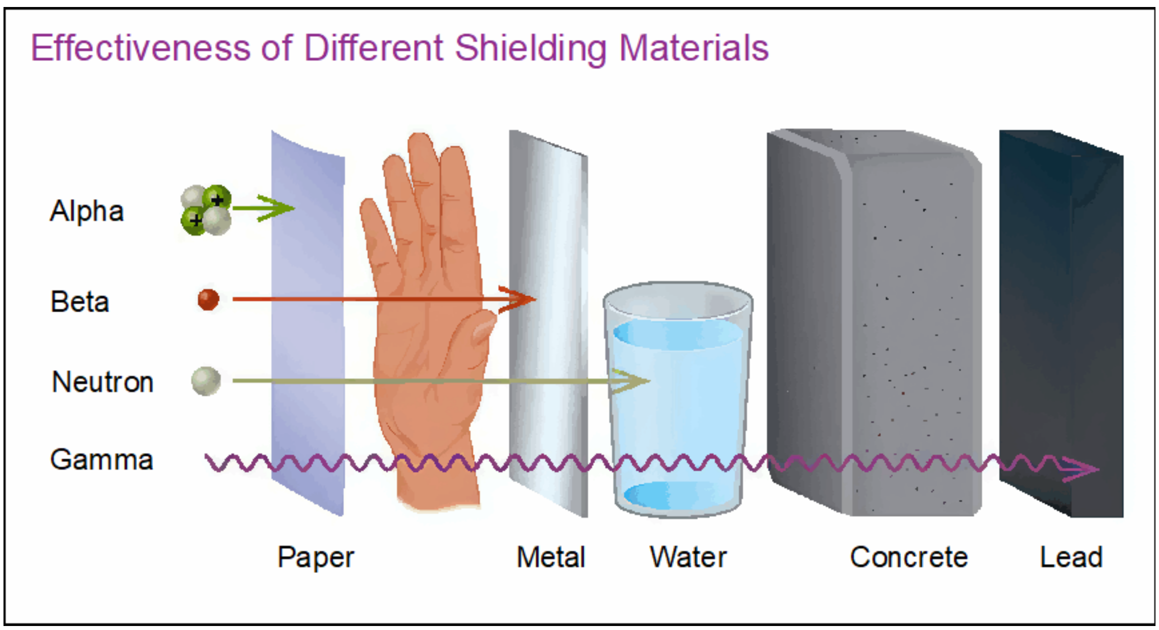

Figure C-3. Effectiveness of Different Shielding Materials

Contamination mitigation measures are discussed in detail in ATP 3-11.33/MCRP 10-10E.12/NTTP 3-11.26/AFTTP 3-2.60, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Mitigation.

(5) **Medical Countermeasures and Treatment.** Stable potassium iodide is the only drug that can be given as a pre-exposure prophylaxis to limit the uptake of radioiodine. Anti-emetics keep personnel from vomiting following radiation exposure. Post-exposure, there are a number of drugs that can be given to remove radioactive material from the body. Two different diethylenetriaminepentaacetic acid products are Food and Drug Administration-approved; these are chelators that can be used but only under medical monitoring since they can be poisonous if the dose is not carefully controlled. Ethylenediaminetetraacetic acid is another chelator similar to diethylenetriaminepentaacetic acid that may be used to treat internal contamination. However, ethylenediaminetetraacetic acid is only Food and Drug Administration-approved for use in the treatment of lead poisoning. Prussian blue can be administered to treat internal contamination by Cs-137 [cesium-137], another common fission fragment, as well as radioactive thallium and non-radioactive thallium. Furthermore, Neupogen, Neulasta, Leukine, and Nplate are Food and Drug Administration-approved to treat a sub-syndrome of acute radiation syndrome. All medical countermeasures should be administered under the supervision of a medical provider to prevent or mitigate side effects.

Medical countermeasures and treatment are discussed in detail in ATP 4-02.83/MCRP 3-40A.2/NTRP 4-02.21/Air Force Manual 44-161(I), Multi-Service Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties.

d. **Risk Management**

(1) The commander’s decision to expose personnel to ionizing radiation should be balanced with mission requirements and all other risks. In combat, it may be necessary to exceed RES categories of radiation exposure due to mission requirements or as a consequence of enemy action. The risk management process is to identify hazards, characterize the risks to the greatest extent possible, and apply mitigation measures to try to eliminate or minimize the risks. The objective is to achieve the lowest-possible overall risk consistent with mission accomplishment.

(2) The staff planner should be aware that risk mitigation measures applied to reduce risk associated with one hazard may increase risk to another hazard. As part of the risk management process, applying radiation safety mitigation measures should act in concert with other risk mitigation measures to minimize the overall risk. The highest risk of significant casualties usually occurs from the conventional weapons threat. Increasing conventional risk to achieve the objective of ALARA may result in an increased total risk with higher probability of mission failure.

(3) Complete risk management requires the following:

(a) **Information.** The staff should work to collect the best available information on all the identified hazards. The risk assessment begins with accurate information on the nature of all hazards present in the operational area, including intelligence assessments, measurements, visual observations, and modeling.

(b) **Justification.** During operational decision making, commanders should consider immediate, operationally significant health effects, as well as long-term consequences of radiation exposure (e.g., cancer), in addition to all other health risks. The importance of the mission should drive acceptability of risk.

(c) **Optimization.** After a risk has been justified, the commander should optimize the plan to minimize the potential effects of all risks that are involved, in the context of the mission. The operational implications of risk mitigation measures should be carefully considered. Optimization balances potential reduction in operational effectiveness inherent in instituting some risk mitigation measures with the potential return in the reduction of risk. For example, use of IPE slows operations but provides protection against internalization of radioactive materials.

(4) The dose contributed by ingestion or inhalation of radioactive material (known as internal dose), partial body irradiations from gamma rays, and skin irradiations from beta particles is difficult to accurately assess in the field. However, such individual doses can be estimated by appropriately trained staff. Depending upon the type of radioactive material and its dispersed form, the combined internal and external dose equivalent may be much larger than the external exposure recorded on a dosimeter. Consequently, respiratory and skin protection are considered whenever the hazard analysis establishes a potential risk where the internal exposure, or skin exposure, causes the commander's OEG to be exceeded. Implementation of respiratory and skin protection controls is subject to common sense tests of being reasonably achievable and practical for the situation.

4. Operational Radiological Risk Management Tools

a. **RES**

(1) RES provides a convenient method to track dose and associated operational impact of exposure. RES is an estimate, indicated by the categorization symbols RES-0 through RES-3 (see Figure C-4), which may be applied to a unit, subunit, or by exception, to an individual. As indicated, RES-1 has multiple levels, each indicating specific recommended actions. RES categories RES-0 through RES-1E are for military operations other than war. RES categories RES-0 through RES-3 are for military combat operations, where all-hazard risks are assumed to be greater. Since RES is directly related to effects of tactical interest, it can be used for estimating the effectiveness of units (or, in exceptional cases, of individuals) and is considered during operational planning to select units or individuals with appropriate capabilities or skills to achieve the lowest RES after the mission is completed.

Radiation Exposure Status Categories

Total Cumulative Dose (See Notes 1 and 2)	Radiation Exposure Status (RES) Category	Recommended Actions (Continue Actions from the Previous RES Categories as RES Increases)
Military Operations Below Armed Conflict		
0 – 0.05 cGy	RES-0	• Routine monitoring for early warning of hazard
0.05 – 0.5 cGy	RES-1A	• Record individual/unit dose readings
0.5 – 5 cGy	RES-1B	• Initiate radiation survey and continue monitoring
5 – 10 cGy	RES-1C	• Update survey and continue monitoring • Continue dose control measures • Execute PRIORITY tasks only (see Note 3)
10 – 25 cGy	RES-1D	• Execute CRITICAL tasks only (see Note 4)
25 – 75 cGy (see Note 5)	RES-1E	• Monitor for acute radiation syndrome symptoms
RES Categories Continue for Military Operations During Combat		
75 – 125 cGy (see Notes 5 and 7)	RES-2	• Any further exposure exceeds moderate operational risk
> 125 cGy (See Notes 5 and 7)	RES-3	• All further exposure will exceed the emergency operational risk

1 rad = 1 radiation absorbed dose = 1 centigray (cGy)

NOTES:

1. Radiation measurements can be in centisievert (cSv) or millisievert (mSv). However, due to the fact that the military may only have the capability to measure centigray (cGy) or milligray (mGy), the radiation guidance tables are presented in units of cGy for convenience. For whole body gamma irradiation, 10 mGy = 1 cGy = cSv = 10 mSv.
2. All doses should be kept as low as reasonably achievable. This will reduce individual Service member risk as well as retain maximum operational flexibility for future employment of exposed Service members.
3. Examples of priority tasks are those that contain risk, avert danger to persons, or allow the mission to continue without major revisions in the operational plan.
4. Examples of critical tasks are those that save lives or allow continued support that is deemed essential by the operational commander to conduct the mission.
5. Although an upper bound for RES 1E is provided in the table, it is conceivable that doses to personnel could exceed this amount. A low incidence of acute radiation sickness can be expected as whole body doses start to exceed 75 cGy. Personnel exceeding the RES 1E level should be considered for medical evaluation and evacuation upon any signs or symptoms related to acute radiation sickness (e.g., nausea, vomiting, anorexia, fatigue).
6. When an operational mission duration spans more than one calendar year and it does not exceed the annual occupational dose limit, the RES Category will be reset to RES 0 on 1 January. All radiation exposure data records are still required to be maintained by the service dosimetry centers.
7. Moderate operational risk is causing 2.5% incidence of latent ineffectiveness. Emergency operational risk is a risk of 5% incidence of latent ineffectiveness. See Department of the Army Pamphlet 50-7, *Personnel Risk and Casualty Criteria for Nuclear Weapons Effects*.

Figure C-4. Radiation Exposure Status Categories

(2) Tracking RES includes keeping and maintaining RES records. RES levels are based on average total cumulative dose received by a unit from exposure to penetrating radiation. The total cumulative dose is most accurately determined by using a dosimeter (see paragraph 3.b.(2), "Personnel Radiation Dosimetry"). If a dosimeter is not used, then the dose can be estimated based on radiation monitoring data and total exposure time. Special advisors (see paragraph 6, "Service Resources") should be consulted for acceptable, alternative methods of assessing these exposures. Figure C-4 defines the RES categories as a function of dose received by the unit and describes the precautions required for units in each of the RES categories. All individuals of the unit or subunit are assigned the same RES based on the determined dose. If personnel are reassigned, the unit RES is determined by the average dose of the individuals assigned. All personnel who have received radiation exposure during operations should be evaluated by medical personnel and appropriate entries documented in their individual medical record in accordance with multi-Service TTP and NATO Standardization Agreement 2473, *Commander's Guide to Radiation Exposures in Non-Article 5 Crisis Response Operations*. The Service dosimetry centers are the primary location for all exposure and dose information processing. Each Service maintains a repository of individual dose information.

b. **Assessing Radiation Hazards**

(1) Determining if the radiological hazards can be controlled depends on whether they are sufficiently characterized and appropriate controls are in place or can be put in place and sufficient resources exist to protect personnel to a level of risk comparable to occupational standards. Under such conditions, commanders should apply the same standards of ionizing radiation protection as would apply to any routine practice involving ionizing radiation exposure and radioactive material as specified in DoDI 6055.08, *Occupational Ionizing Radiation Protection Program.* Commanders may require dose limits specified in DoDI 6055.08 be exceeded in emergency situations and during combat or wartime military operations.

(2) A sufficiently characterized radiological hazard normally includes an evaluation of the environment by a radiation SME such as a health physicist or radiation specialist. Characterization normally includes identifying the radionuclide(s) (or ionizing radiation type, radiation energy, and half-life of the source), determining whether the hazard is contained or dispersed, quantifying the dose rate, and determining how the dose rate changes over time. Commanders should consult with available expertise and use available resources to characterize the environment to the best of their ability. Reachback and staff augmentation is available from several sources within each Service, DTRA, United States Northern Command's Joint Task Force-Civil Support, and the Armed Forces Radiobiology Research Institute.

(3) In contrast, environments are uncontrolled when they are uncharacterized or limited resources exist to reduce personnel exposure to ionizing radiation. Under such circumstances, commanders should apply operational risk management to protect personnel to the greatest extent possible. Requirements under these conditions include limiting exposures to those that are both justified and ALARA, as well as applying OEG instead of dose limits.

c. **Determine the Radiological Risk**

(1) To assess the risk in a radiological environment, estimate the potential dose and dose rate from radiological sources that may be encountered during the mission. This determines the severity of the radiological threat. Next, determine the likelihood of encountering this radiological threat. This determines the probability of exposure. Figures C-5 and C-6 provide severity and probability descriptions.

(2) Once the severity and the probability of the hazard are determined, Figure C-7 correlates the two to determine the level of risk associated with the hazard.

d. **Setting an OEG**

(1) The OEG is set for each platoon or equivalent unit and for each mission. The OEG should be based on the importance of the mission and the acceptable tolerance to ionizing radiation effects in comparison to other risks associated with the mission. The risk management process begins by selecting a conservatively low OEG. As an example, use Figure C-8 to determine OEG and assess the impact to the mission. If there is no

Severity of Radiological Threat

Level of Severity	Mission Impact	Associated Potential Dose and Dose Rate
Catastrophic	• Expected loss of ability to accomplish mission	• Total dose > 450 centigray • Encounter source/environment with dose rate > 200 centigray per hour
Critical	• Expected significant degradation of mission capabilities in terms of the required mission standard • Inability to accomplish all parts of the mission • Inability to accomplish the mission to standard if hazards occur during the mission	• Total dose > 200 centigray • Encounter source/environment with dose rate > 10 centigray per hour
Marginal	• Expected degraded mission capabilities in terms of the required mission standard; mission capability will be reduced if hazards occur during the mission	• Total dose > 75 centigray • Encounter source/environment with dose rate > 0.5 centigrays per hour
Negligible	• Expected effect will have little or no impact on accomplishing the mission	• Total dose > 25 centigray • Encounter source/environment with dose rate > 0.01 centigray per hour

NOTE:
1 rad = 1 radiation absorbed dose = 1 centigray

Figure C-5. Severity of Radiological Threat

Probability of Radiological Threat

Probability of Event	Descriptive Probabilties
Frequent	• Expected to occur several times or continuously over the duration of a specific mission
Likely	• Expected to occur during a specific mission or at a high rate but intermittently
Occasional	• May occur as often as not during a specific mission • Occurs sporadically
Seldom	• Not expected to occur during a mission • Occurs rarely as isolated incidents
Unlikely	• Occurrence not impossible but can assume will not occur during a mission • Occurs very rarely

Figure C-6. Probability of Radiological Threat

foreseeable impact on the mission, then the low OEG should be appropriate. If not, raise the guidance to a less conservative (i.e., higher) OEG and repeat the process. Note that the risks should be monitored and reassessed as needed throughout the mission, allowing the OEG to be modified as necessary to keep risks as low as practical.

(2) The recommended levels for the exposure guidance given in Figure C-8 are low enough that the primary risk is limited to an increased risk of long-term health effects, except for a critical mission with an extremely high acceptable risk, or for those who have already received a significant dose of radiation. This table is intended to guide commanders and their staffs in determining an appropriate OEG.

(3) **Critical** missions are those missions that are essential to the overall success of a higher headquarters' operation, emergency lifesaving missions, or the equivalent.

(4) **Priority** missions are those missions that avert danger to persons, prevent damage from spreading, or support the organization's mission-essential task list.

(5) **Routine** missions are all other missions that are not designated as priority or critical missions.

(6) In all cases, if following the OEG introduces additional risks or hazards otherwise avoidable, a reassessment of the OEG is warranted. It is not reasonable to set the OEG so low it introduces other more severe or unnecessary risks. For example, if the OEG is set so a route is not usable because of the possibility of exceeding the OEG and other routes introduce the potential for unnecessary adversary engagement or other

Level of Radiological Risk

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	Extremely High	Extremely High	High	High	Moderate
Critical	Extremely High	High	High	Moderate	Low
Marginal	High	Moderate	Moderate	Low	Low
Negligible	Moderate	Low	Low	Low	Low

Figure C-7. Level of Radiological Risk

significant danger. Commanders should reassess the risks and the importance of the mission, consider additional dose reduction mitigation measures, or increase the OEG.

e. Commanders should establish an OEG for the following situations:

(1) All missions with the potential for ionizing radiation exposure.

(2) Units conducting radiological decontamination of personnel or equipment.

(3) Units conducting immediate or operational decontamination.

(a) Unlike chemical or biological agents, radiation is not neutralized by decontamination. Decontamination only moves the hazard from one surface (bodies, vehicles, etc.) to another (the containment). Removed contaminated clothing and wastewater may themselves, under certain conditions, become radiation hazards. Therefore, contaminated clothing and wastewater should be treated as radioactive hazards. Wastewater should be controlled to prevent further spread of contamination.

Recommended Operational Exposure Guidance Levels

Acceptable Risk Level \ Mission Importance	Critical	Priority	Routine
Extremely High	125 centigray	75 centigray	25 centigray
High	75 centigray	25 centigray	5 centigray
Moderate	25 centigray	5 centigray	0.5 centigray
Low	5 centigray	2.5 centigray	0.5 centigray

NOTES:

1. rad = 1 radiation absorbed dose = 1 centigray
2. The commander has the authority to select any operational exposure guidance deemed appropriate, including exceeding 125 centigray, if the circumstances warrant it.

Figure C-8. Recommended Operational Exposure Guidance Levels

(b) An appropriate OEG should be set for units conducting thorough decontamination operations (i.e., consider the decontamination operation a separate mission with its own OEG).

(4) Radiological risk management applies to patient movement missions and health care providers; however, medical treatment or lifesaving measures take precedence over decontamination efforts.

(a) Mission OEG should be established for medical missions; however, careful consideration must be given before evacuation or treatment for a contaminated individual to avoid exceeding the OEG for evacuation crews or health care personnel. It is highly unlikely a contaminated patient creates a significant radiation hazard for health care providers. In most cases, removing the outer layer of clothing eliminates most of the radioactive contamination and general medical precautions are sufficient to protect medical personnel from the radiological hazard.

(b) Treatment of radioactively contaminated casualties triaged as "immediate" should not be delayed for decontamination beyond removal of the outer layer of clothing. Decontamination can be safely delayed until immediate lifesaving actions have been accomplished and the delay/interference of decontamination does not threaten any personnel.

(5) Radiological risk management applies to all ground, air, and sea transportation missions. Risk to the transportation personnel, crew, and the mission requirements is factored into the decision process when setting the OEG. If transporting radioactive material (such as toxic industrial radiologicals), both the cargo and any other potential ionizing radiation exposure should be evaluated in the risk management process. For radioactively contaminated cargo, the decontamination requirement should be evaluated as part of the risk management process. Depending on the cargo and the mission, the OEG for the crew and transportation personnel may make decontamination unnecessary. Planning for intertheater transportation missions should consider the radiological control requirements at the destination. An intermediate intratheater stop may be required to conform to HN and international transportation requirements. Consult the memorandum from the Under Secretary of Defense for Policy, *Radiological Clearance Criteria Guidelines for Platforms and Materiel*, dated 16 December 2011, before transporting radiologically contaminated materiel out of theater.

(6) When conducting defense support of civil authorities, the JFC or subordinate commander should consider input from the federal coordinating officer or the incident commander. Regulatory guidance provided by the Occupational Safety and Health Administration should be followed to establish risk guidance for radiation exposures.

f. **Determining Decontamination Requirements**

(1) Immediate or operational decontamination should be completed to reduce the possibility that residual contamination exceeds the OEG. Once the mission is completed or before beginning a new mission, thorough decontamination may be necessary to avoid additional exposure or exceeding any newly established OEG and to keep exposure ALARA.

(2) Title 49, Code of Federal Regulations, parts 172 and 173, and Nuclear Regulatory Commission Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*, provide guidance during peacetime environments for movement, disposal, and release of radiologically contaminated equipment and buildings for unrestricted use within the United States.

(3) Under most conditions, up to 10 times background, typically averaging ~2 microgray/hour, is an acceptable OE.

5. Additional Exposure Guidance

a. Internal uptake of radioactive material can contribute a significant dose to an individual, possibly impacting the risk management process. Internal uptake can be precluded by the use of IPE or COLPRO, but this mitigation measure is not always practical or may not be the most effective approach in reducing total risk. Internal dose assessment should be performed by a trained expert (see paragraph 6, “Service Resources”), with the following general considerations:

(1) Exposure can be assessed from nasal swabs (if done within one hour post exposure for certain radionuclides).

(2) Assess via bioassay (blood, urine, feces, sputum) as soon as possible. Bioassay is the determination of the relative strength of a substance (as a drug) by comparing its effect on a test organism with that of a standard preparation. This normally requires special analysis by a qualified laboratory facility (see paragraph 3.b.[3], "Laboratory Grade Capabilities").

b. Priority should be given to nuclide identification. Alpha and beta emitting radionuclides are particularly hazardous if they are internalized.

(1) Affects internal dose assessment and treatment.

(2) Determines long-term IPE (MOPP)-level guidance.

c. **Protection of Civilians**

(1) General criteria for implementing protective actions:

(a) Seek to prevent threshold (i.e., acute) health effects.

(b) The risk of delayed effects should not exceed a level that is judged to be adequately protective of health in emergency situations.

(c) The risk from a protective action should not exceed the risk associated with the dose that is to be avoided.

(2) Commanders should coordinate with local authorities, in accordance with status-of-forces agreements and locally published guidance, to establish appropriate guidance for the protection of dependents and other civilians.

(3) For additional information on intervention levels for the protection of the public during domestic and foreign situations see:

(a) The *National Response Framework* for domestic response guidance and information.

(b) NATO Standardization Agreements, International Atomic Energy Agency safety series documents, and ICBRN-R doctrine.

6. Service Resources

In addition to the Service resources already identified for personnel dosimetry and radioanalytical laboratory services, each Service has uniformed and civilian radiation safety experts (health physicists) and dedicated radiation safety agencies. Service-specific identification and contact information follows:

a. US Army
Expert: Nuclear Medical Science Officer
Agency: USAPHC Health Physics Program
Address: USAPHC
ATTN: MCHB-PH-HPH
5158 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5403
E-mail: chppm-hpp-webrequest@amedd.army.mil
Phone: 410-436-8396
DSN: 584-8396

b. US Navy
Expert: Radiological Health Officer
Agency: Navy and Marine Corps Public Health Center
Address: 620 John Paul Jones Circle, Suite 1100
Portsmouth, VA 23708-2103
Phone: 757-953-0765 (Radiological Component Manager)
DSN: 377-0765

c. US Air Force
Expert: Bioenvironmental Engineer
Agency: US Air Force School of Aerospace Medicine
Address: 2510 5th Street, Building 840
Wright-Patterson AFB, OH 45433-7913
E-mail: esoh.service.center@us.af.mil
Phone: 937-938-3764/1-888-232-3764
DSN: 798-3764

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APPENDIX D
NUCLEAR HAZARD CONSIDERATIONS

1. General

The international security environment encompasses threats from potential adversaries armed with nuclear weapons. This appendix summarizes common effects produced by nuclear weapons, high-energy radiation, and radiological materials to assist CCDRs and subordinate commanders to plan for and conduct operations in nuclear environments. The effects of radiation exposure described in Appendix C, "Radiological Hazard Considerations," also apply to the residual radiation, including fallout, from a nuclear explosion.

2. Characteristics of Nuclear Weapons

a. The nature and intensity of the effects of a nuclear detonation depend upon the characteristics of the weapon, the target, the means of employment, and the height of burst. The most significant characteristics of a nuclear weapon are its type and yield.

b. **Types of Nuclear Weapons.** Nuclear weapons release enormous amounts of energy liberated from the fission or fusion of atomic nuclei.

(1) Fission-based weapons utilize specific isotopes of heavy elements, such as uranium or plutonium, as the fissile fuel for the fission reactions. Though still technically complex to develop, they are less sophisticated than fusion-based weapons. As a result, they are more likely to be developed or used by underdeveloped nations or terrorist groups.

(2) Fusion-based weapons exploit the energy released when the nuclei of light elements, such as isotopes of hydrogen, combine to form heavier nuclei, and are often referred to as hydrogen bombs or H-bombs. Fusion-based weapons require very high temperatures to enable fusion reactions and may also be referred to as thermonuclear weapons. Since fusion-based weapons require much greater technological sophistication and are more efficient, more technologically mature nations are likely to adopt this weapon type.

c. **Yield.** The term yield is used to describe the amount of explosive energy released when a nuclear weapon is detonated. A nuclear weapon's yield is measured in units of tons of TNT that would produce an equivalent explosion. Fission-based weapons are capable of producing yields up to a few hundred kilotons. Thermonuclear weapons can produce yields in excess of 1 megaton.

3. Nuclear Weapons Effects

a. The effects of a nuclear weapon are largely determined by the medium in which it detonates. A nuclear weapon may be detonated in space, in the air at a high or low altitude, on the surface, below the surface, or under water. Data in this appendix focuses on air bursts. Figure D-1 depicts a model of blast, thermal, and nuclear radiation effects for a weapon detonated above the ground. The example effects are for personnel in the open on flat terrain. Significant effects on personnel are limited to about 2 kilometers; personnel in armored vehicles fare much better.

b. When detonated, a typical nuclear weapon releases its energy as overpressure (positive and negative pressure waves), thermal radiation, ionizing radiation (alpha and beta particles, gamma rays, X-rays, and neutrons), and EMP. Figure D-2 depicts the relative proportions of the radiation products of an air burst nuclear explosion. When the detonation occurs in the atmosphere, the primary radiation products interact with the surrounding air molecules and are absorbed by matter and scattered as they radiate from the point of detonation. The secondary radiation products, referred to as residual radiation or fallout, produce the preponderance of the radiation hazard and casualties beyond the immediate point of detonation. All of these interactions lead to the five significant effects of a nuclear weapon detonated in the air: blast, thermal radiation, ionizing radiation, fallout, and EMP.

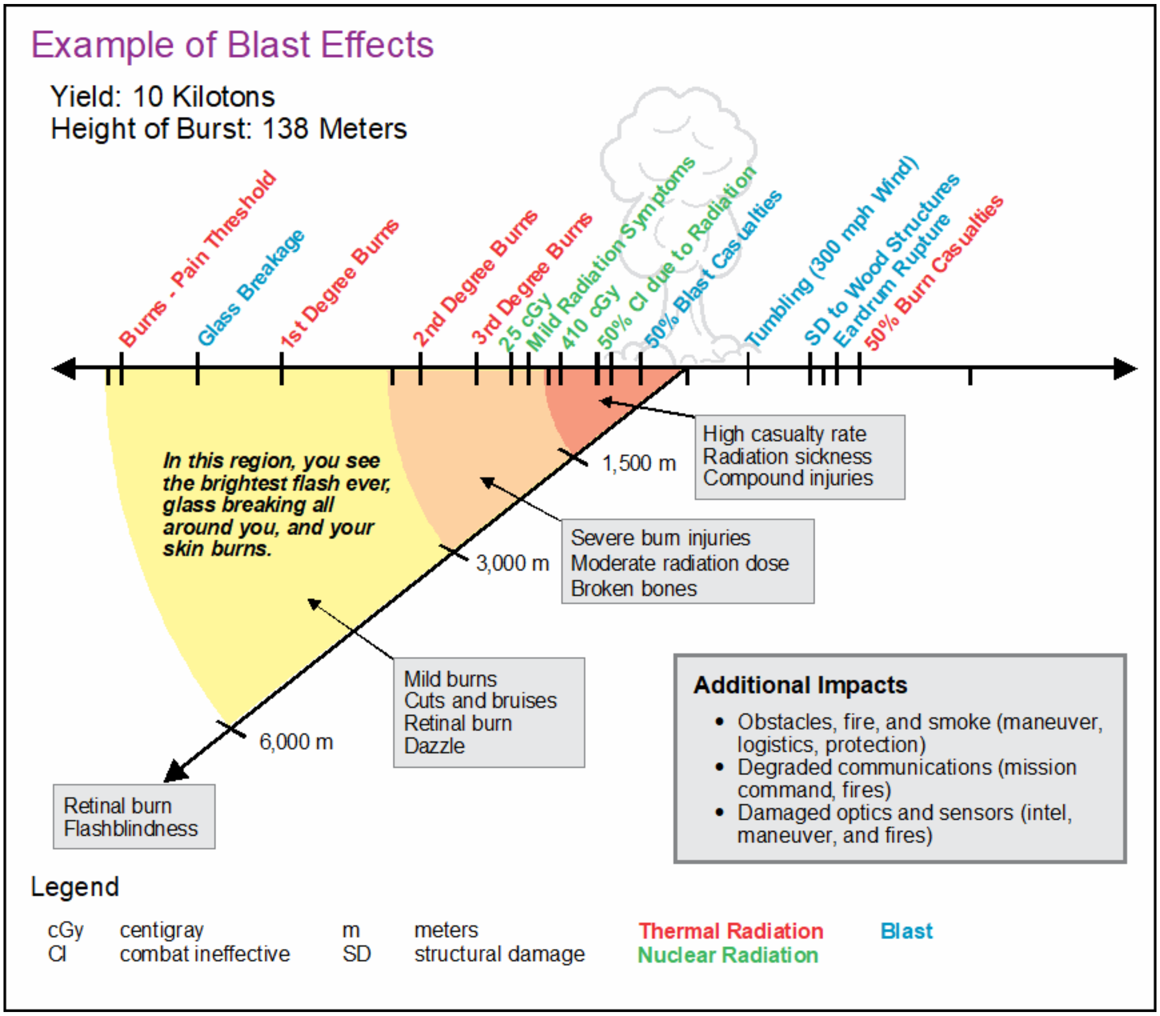

Figure D-1. Example of Blast Effects

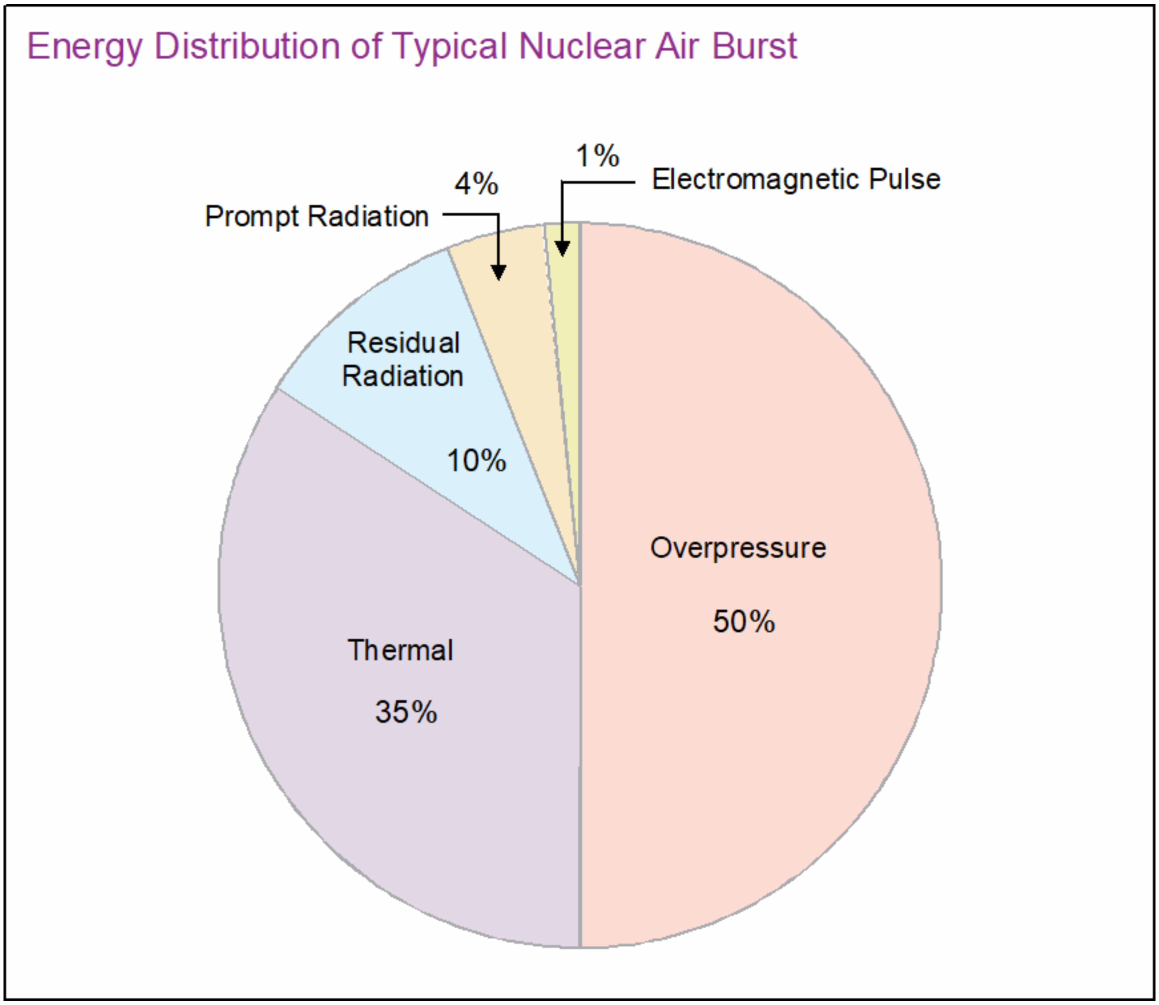

Figure D-2. Energy Distribution of Typical Nuclear Air Burst

For additional technical data, including nuclear weapon employment effects data, contact the United States Army Nuclear and Countering Weapons of Mass Destruction Agency.

c. **Overpressure.** A low-altitude nuclear air burst generates overpressure (and resulting negative pressure waves) and severe winds. These pressure waves produce casualties and damage through crushing, bending, tumbling, and breaking. Many of the casualties will be injured by flying debris, such as broken glass and rubble. Depending upon a weapon's yield and detonation location, the pressure waves from a nuclear weapon are capable of destroying most of the infrastructure of a major city, including rendering roads impassable; disrupting water, sewer, gas, electrical, and phone lines; and destroying medical facilities. Commanders should anticipate these challenges when operating in a nuclear environment.

d. **Thermal Radiation.** In certain circumstances, the effect of the enormous amount of heat and light released by a nuclear detonation may be more damaging than the blast. The thermal radiation from a multimegaton weapon can ignite wood, paper, rubber, plastics, and other materials many kilometers away from the detonation point. Because thermal radiation travels at the speed of light, flammable objects within the thermal range and line of sight of the blast ignite immediately. Even a 10-kiloton weapon is capable of igniting flammable objects within several hundred meters of its detonation point. Additionally, thermal radiation causes burns of various degrees to people in the line of sight of the explosion. Severe burn victims generally require intensive and sophisticated medical treatment, which may quickly overwhelm available medical support. Commanders should be aware of, and take steps to mitigate, thermal radiation effects while operating in a nuclear environment.

e. **Ionizing Radiation.** Ionizing radiation produced from a nuclear detonation occurs in two forms, prompt radiation and residual radiation.

(1) Prompt radiation (X-rays, gamma rays, and neutrons) is produced within the first minute of a detonation and is emitted directly from the nuclear reactions characteristic to the type of weapon employed.

(2) Residual radiation is produced after the first minute after detonation, principally from the decay of radioisotopes produced during the explosion and is found on environmental material, unfissioned weapon debris, and radioactive fission products swept up into a debris cloud. This debris cloud moves with prevailing winds and rains down to the ground as fallout depositing radioactivity over hundreds to thousands of kilometers around the detonation point. The resulting fallout produces residual radiation in the form of gamma, beta, and alpha particles and therefore becomes a significant hazard to personnel and materiel.

(3) Acute radiation doses from prompt or residual radiation can cause biological harm, leading to severe illness or death. Additionally, intense ionizing radiation can damage objects, including optical, mechanical, and electronic components, by altering their physical properties. Gamma rays and neutrons have a long range in the air and are highly penetrating. Consequently, even people inside of buildings and behind solid objects receive some radiation.

f. **Fallout.** Fallout is the residual radiation product distributed into the atmosphere by a nuclear detonation. High-altitude bursts produce essentially no terrestrial fallout. For many weapon designs, low-altitude bursts in which the fireball does not touch the ground very often produce little, in some cases negligible, amounts of fallout. All nuclear detonations close enough to the surface for the fireball to touch the ground produce very large amounts of radioactive debris that are drawn up into the atmosphere and deposited locally and dispersed downwind. Although fallout initially decays quickly, some areas could remain hazardous for years. Radiological surveys are needed to identify and characterize such areas. Localized fallout may severely limit military operations within a contaminated area. Civilian and military facilities and resources are likely to be overwhelmed by the requirements for fallout casualty decontamination, processing, and treatment. Additionally, decontamination, identification, and interment of remains are formidable challenges for commanders to overcome. Figure D-3 shows a model of radiation dose from fallout created by a nuclear weapon. The graphic on top shows the

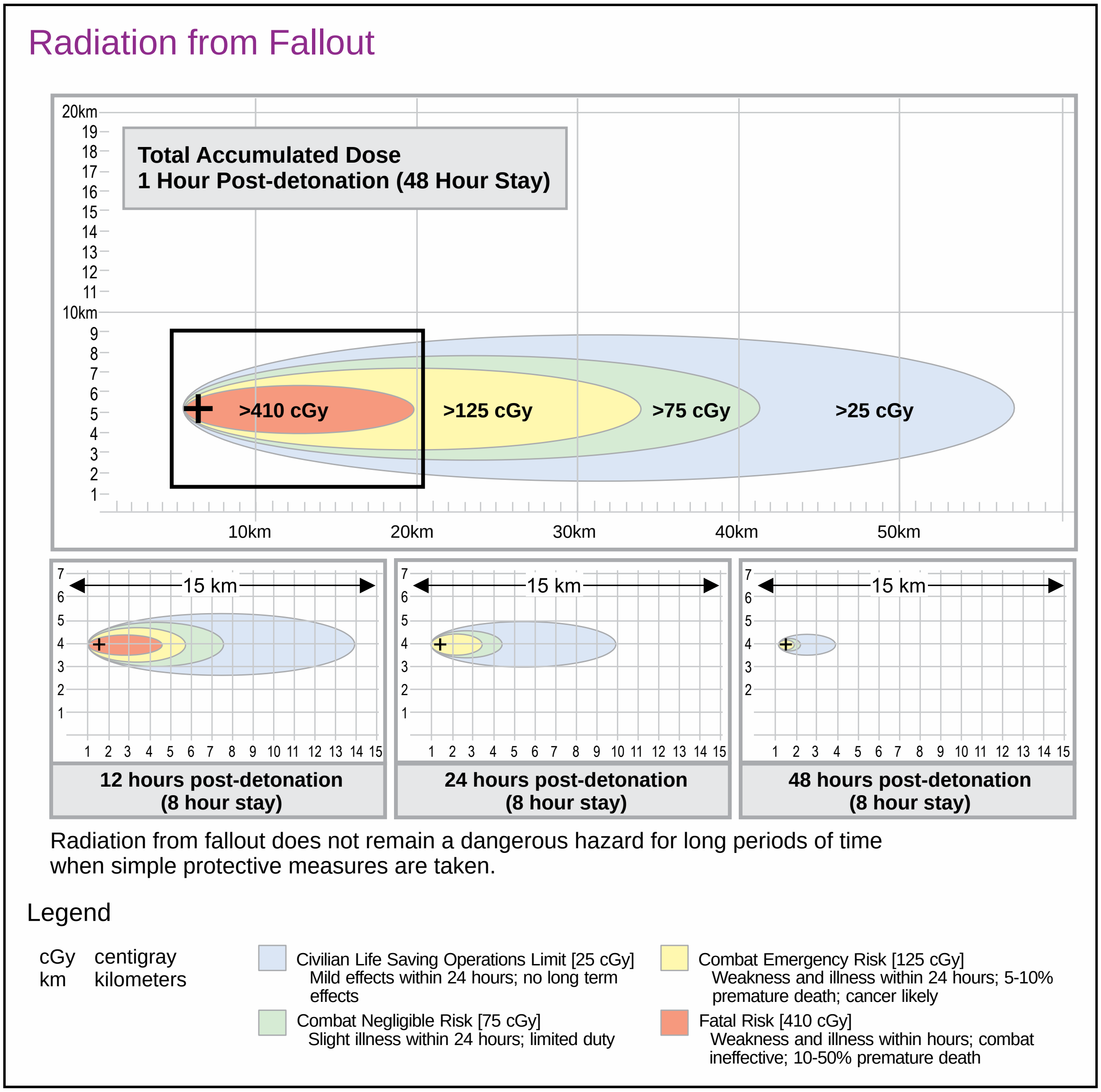

Figure D-3. Radiation from Fallout

radiation absorbed if a person arrived at a spot one hour after a detonation and remained there in the open for 48 hours. The bottom graphics show the absorption for personnel arriving at the same spot 12, 24, and 48 hours after detonation and staying for eight hours.

g. **EMP.** EMP is a strong burst of electromagnetic radiation caused by a nuclear explosion, directed energy weapon, or by natural phenomenon, that may couple with electrical or electronic systems to produce damaging current and voltage surges. Nuclear-generated EMP is a potential threat to all electrical, electronic, and electromagnetic spectrum-dependent systems. Its magnitude, duration, and range are dependent upon the height of burst and weapon yield. A high-altitude EMP can generate significant disruptive field strengths over a continental-size area, whereas a directed energy weapon (i.e., electromagnetic attack systems) can generate significant disruptive field strengths to a more localized area or a specific target.

For further information on EMP effects, see JP 3-85, Joint Electromagnetic Spectrum Operations. *Also see Military Standard 2169D Note 1,* (S) High-Altitude Electromagnetic Pulse (HEMP) Environment, *Military Standard 464D,* (U) Electromagnetic Environmental Effects Requirements for Systems, *and DTRA-TR-14-71-Rev.2,* Defense Threat Reduction Agency Nuclear Survivability Program Guidebook.

h. **Combined Effects.** Although each nuclear weapon effect is addressed separately, the planner should consider possible synergism of their combined effects on structures, equipment, and personnel. Structures may be burned, crushed, knocked down, or contaminated. Equipment may be disabled or destroyed by the combined effects of EMP, thermal blast, and ionizing radiation. Personnel may experience the effects of ionizing radiation in conjunction with conventional injury, and while each effect considered separately may not be sufficient to cause death, taken together, they could cause lethal damage.

i. **Operational Planning.** When planning for nuclear environments, the JFC should plan for sufficient survivability measures to enable conventional force units to continue mission-critical operations after exposure to nuclear effects. The destructive power of nuclear weapons requires measures to reduce vulnerabilities and to increase survivability of US and friendly forces. Commanders require situational awareness for the essential, rapid assessment of the effects of nuclear weapons to determine appropriate actions and responses, including long-term effects on future operations. The timeliness and effectiveness of such assessment depend on commanders' prior identification of measures that are clear, observable, and preferably quantifiable. The immediate impact on combat power can be degradation of the joint force's ability to accomplish current and future missions. The delayed effects of a nuclear environment are survivability challenges caused by residual contamination.

For further information on the operational impacts of nuclear weapons effects, see JP 3-72, Joint Nuclear Operations.

4. Protective Actions

a. Protective actions taken before an attack are most effective for survivability of personnel and equipment. Mitigation can include, for example, wearing one or two layers of loose, light-colored clothing that can reduce burns; use of bunkers, reverse slopes, depressions, culverts, and caves; and dispersion. Education and training of leaders, staffs, and individuals on nuclear weapons effects and the principles of operations in CBRN environments can significantly enhance operational effectiveness in the event of nuclear attack.

For more details on individual and collective protective actions, see ATP 3-11.32/MCRP 10-10E.11/NTTP 3-11.27/AFTTP 3-2.46, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Protection.

b. Commanders operating in radiological and nuclear environments minimize and control the exposure of personnel to radiation. As described in Appendix C, "Radiological Hazard Considerations," an OEG is established for all military operations. See Appendix C, "Radiological Hazard Considerations," for further information on setting the OEG, RES categories, military radiation exposure states, and risk criteria. Also see ATP 4-02.83/MCRP 3-40A.2/NTRP 4-02.21/Air Force Manual 44-161(I), *Multi-Service Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties.*

c. **EMP Hardening.** Electromagnetic hardening protects personnel, facilities, and equipment by filtering, attenuating, grounding, bonding, blanking, and shielding against undesirable effects of electromagnetic energy such as that caused by EMP. While some military equipment is hardened against the effects of EMP, many military systems and commercial-off-the-shelf items are not. The cost of retroactively hardening a system is often prohibitively expensive. Preventive measures include keeping cable runs as short as possible and not elevated, keeping enclosures shut, and turning off and unplugging any unused equipment. Use at least a lightning-rated surge protection device on power cords, antenna lines, and data cables; maintain spare surge protection devices; and have either EMP-protected backup power or a generation source that is not connected to the grid with one week of on-site fuel or equivalent (e.g., renewable source). When warnings are issued, penetration by EMP into equipment can be minimized by immediately shutting down electronic equipment (such as radios, computers, and generators) and disconnecting radio antennas, data (e.g., Internet) cables, and power cables. Use priority phone services like the Government Emergency Telecommunications Service, Wireless Priority Services (for cell phones), and Telecommunications Service Priority; and join the SHAred RESources high frequency radio program, if applicable.

For more information on mitigation of electromagnetic effects, see JP 3-85, Joint Electromagnetic Spectrum Operations.

d. Nuclear environments are unique in that they are transient but some equipment and systems may be required to operate through the event. It is important during system acquisition to analyze nuclear hardness needs and establish appropriate requirements early in the process. If a system is nuclear hardened, a robust hardness maintenance and hardness surveillance program should be established and supported by commanders.

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APPENDIX E
(U) NONTRADITIONAL AGENT HAZARD CONSIDERATIONS

This appendix is a classified supplement provided under separate cover. The classified appendix expands information related to NTA environments.

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APPENDIX F
CONTAMINATION MITIGATION CONSIDERATIONS

1. General

The hazards associated with CBRN incidents can force US forces into protective equipment, thereby degrading their ability to perform individual and collective tasks. CCMD staffs plan, prepare for, and provide support to contamination mitigation operations and for redeployment of platforms and materiel to home stations once hostilities cease. Contamination mitigation includes the planning and initiation of actions that enable the force to continue operations despite threats and hazards from CBRN material through the conduct of contamination control, decontamination, and medical countermeasures that allow for quick recovery.

2. Terminology

a. **Forms of Contamination (Figure F-1).** CBRN contamination is the deposition on, or absorption of, CBRN materials by personnel, materiel, structures, and terrain. US forces may encounter CBRN contamination through direct attack, movement through contaminated areas, the unwitting use of contaminated facilities, or the movement of vapor clouds.

b. **Levels of Decontamination (Figure F-2).** The levels of decontamination are immediate, operational, thorough, and clearance. Immediate and operational decontamination operations are typically conducted at the tactical level to sustain combat

Forms of Chemical, Biological, Radiological, and Nuclear Contamination

Form of Contamination	Description
Vapor	Can be generated by generators or bursting munitions. Vapor in an open or outdoor area will generally disperse rapidly.
Liquid	Liquid droplets can range from thick and sticky to the consistency of water. Liquids can also be disseminated as an aerosol.
Aerosol	Is a liquid or solid composed of finely divided particles suspended in a gaseous medium. Examples of common aerosols are mist, fog, and smoke. They behave much like vapors.
Solids	Forms of contamination include radioactive particles, biological spores, and dusty agents. A dusty agent is a solid agent that can be disseminated as an aerosol.

Figure F-1. Forms of Chemical, Biological, Radiological, and Nuclear Contamination

Levels of Chemical, Biological, Radiological, and Nuclear Decontamination

Level of Decontamination	Description
Immediate Decontamination	Immediate decontamination carried out by individuals immediately upon exposure to save lives, minimize casualties, and limit the spread or transfer of contamination.
Operational Decontamination	Decontamination carried out by an individual and/or a unit, restricted to specific parts of operationally essential equipment, materiel, and/or working areas, in order to minimize contact and transfer hazards and to sustain operations.
Thorough Decontamination	This is accomplished by units (with or without external support) to reduce contamination on personnel, equipment, materiel, and/or working areas equal to natural background or to the lowest possible levels, to permit the partial or total removal of individual protective equipment and to maintain operations with minimum degradation.
Clearance Decontamination	The final level of decontamination that provides the decontamination of equipment and personnel to a level that allows unrestricted transportation, maintenance, employment, and disposal.

Figure F-2. Levels of Chemical, Biological, Radiological, and Nuclear Decontamination

operations. Thorough decontamination is normally done within the rear area. Clearance decontamination operations are normally conducted post-hostilities using theater or higher-level assets to prepare contaminated forces for redeployment.

c. **Methods of Decontamination (Figure F-3).** Decontamination is accomplished by neutralization, physical removal, weathering, and biothermal methods.

3. Considerations for Decontamination Operations

a. **Capabilities.** CCDRs and their staffs should consider their decontamination equipment capability and the detection threshold levels of their sensors during planning, as necessary. This planning requirement includes identification of in-theater logistics sites, to include aerial ports of debarkation (APODs) and seaports of debarkation (SPODs).

b. **Treaties and Regulations.** CCDRs with geographic AORs should review applicable treaties, laws, regulations, and agreements pertaining to the AOR, as well as understand and consider foreign government concerns for the movement of contaminated platforms and materiel. CCDRs identify relevant governmental and nongovernmental HN, international, and US entities that may affect operational decision making in moving platforms and materiel. CCDRs use this information to develop policies, standards, plans, and concepts of operation to sustain operations and restore operational capability to platforms and materiel that have been contaminated.

Methods of Chemical, Biological, Radiological, and Nuclear Decontamination

Methods of Decontamination	Description
Neutralization	Is the most widely used method of decontamination, particularly for chemical warfare agents. Neutralization is the reaction of the contaminating agent with other chemicals to render the agent less toxic or nontoxic.
Physical Removal	Is the relocation of the contamination from one mission-critical surface to another less important location. Physical removal generally leaves the contamination in toxic form. It often involves the subsequent neutralization of the contamination.
Weathering	Involves such processes as evaporation and irradiation to remove or destroy the contaminant. The contaminated item is exposed to natural elements (e.g., sun, wind, heat, precipitation) to dilute or destroy the contaminant to the point of reduced or negligible hazard.
Biothermal	Uses heat and humidity as a kill mechanism against biological agents. The contaminated item is exposed to heat (e.g., 170 degrees Fahrenheit) and humidity (approximately 90% relative humidity) for a specified duration to neutralize the biological hazard.

Figure F-3. Methods of Chemical, Biological, Radiological, and Nuclear Decontamination

c. **Personnel Decontamination.** When a CBRN incident occurs, a decontamination operation may be required. Not all contaminated personnel may require medical attention. There are different techniques within the levels of decontamination that may be employed to mitigate risk to personnel from contamination. Both personnel decontamination and patient decontamination may be required, depending on injuries. When a CBRN incident results in mass casualties, a mass casualty decontamination operation may be required. Those contaminated personnel that require medical attention may fall into one of the following categories:

(1) **Casualties.** Casualties consist of injured personnel that do not necessarily need treatment or admittance to a medical treatment facility. These personnel may require self-aid or buddy aid assistance or may just need to go through the decontamination process.

(2) **Patients.** These personnel require medical treatment, life or limb-saving care, or evacuation to the next role of care. It is important these patients go through patient decontamination before they are admitted to the medical treatment facility. However, in some CBRN incidents, little or no decontamination may be necessary to process a patient, especially if lifesaving measures are time critical. If transport is deemed essential, all efforts are made to prevent the spread of contamination. In these cases, prior approval is required from the CCDR; Commander, USTRANSCOM; and SecDef in consultation with DoD medical authorities.

For further guidance on casualty and patient decontamination, see ATP 4-02.7/MCRP 4-11.1F/NTTP 4-02.7/AFTTP 3-42.3, Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment; *current USTRANSCOM policies; and JP 4-02,* Joint Health Services.

d. **Logistics.** While decontamination logistic considerations are normally addressed by the Services, whenever possible, theater-level bulk reserves/stocks should be planned to facilitate resupply.

For more information on logistics, see JP 4-0, Joint Logistics.

For more information on decontamination operations, see ATP 3-11.33/MCRP 10-10E.12/NTTP 3-11.26/AFTTP 3-2.60, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Mitigation.

e. The contaminated remains of military working dogs should be handled in a similar method as human remains. The dog's identification is documented with as much information as possible. Some of the information can be obtained from the handler if available, but should include ear tattoo, microchip number, name, and breed.

f. **Guidelines for Formerly Contaminated Platforms and Materiel**

(1) Formerly contaminated platforms and materiel that undergo thorough decontamination may be used to meet mission requirements, but under restrictions. They remain under USG control and are restricted to DoD-controlled facilities, unless cleared by partner nations (for locations outside the United States).

(2) When mission requirements allow, formerly contaminated platforms and materiel are decontaminated to clearance criteria (unrestricted operations). These measures reduce the health risk from formerly contaminated platforms and materiel. Platforms and materiel that are not decontaminated to clearance criteria and approved for transit should not depart the theater of operations without authorization from USTRANSCOM and in coordination with the affected CCDR and SecDef. Department of State is the approval authority for platforms porting in areas outside the United States in coordination with those countries in which the platforms are porting. The approval authority for porting locations within the United States is SecDef, after obtaining the President's approval, in consultation with appropriate federal and state agencies. Clearance standards for DoD, national, and international agencies may vary. Consult appropriate authority.

(3) CCDRs use clearance criteria guidelines established by the Office of the Under Secretary of Defense for Policy and current national/international guidelines. When more than one standard is presented, the more conservative approach should be taken. Complete elimination of CBRN contaminants from platforms and materiel may not be possible due to limitations in currently fielded technologies and procedures. Furthermore, chemical agents absorb into porous materials such as rubber, plastic, and cloth and may

become an off-gassing or contact hazard even after decontamination operations are complete.

(4) Documentation of the certified clearance level decontamination should be maintained and tracked in the appropriate maintenance records physically maintained for the platforms or materiel.

g. **Clearance Approval Process.** Figure F-4 illustrates the step-by-step process leading to approval to reoccupy the platform or use/transport materiel. Clearance criteria are the processes and measured levels by which decontamination efforts are considered acceptable for the restoration to routine use of a platform and materiel by unprotected personnel. By achieving clearance decontamination, unprotected civilians may conduct routine maintenance, fueling, inspections, loading/unloading, or similar activities. Passengers may include members of the non-DoD general population following clearance decontamination. The assumptions are as follows:

(1) DoD has the policy, standards, and protocols required to assess and characterize contamination.

(2) The JFC identifies the presence of a CBRN hazard and determines whether it has been mitigated.

(3) The source, type, and amount of contamination have been characterized.

(4) The hazard has been reduced to an acceptable exposure level.

(5) The equipment will be used by unprotected persons, except for depot-level maintenance activities.

(6) DoD policy guidelines for chemical, biological, or radiological clearance for platforms and materiel are followed.

For more information on clearance of contaminated platforms and materiel see Department of Defense Manual 3145.03, DoD Chemical, Biological, and Radiological (CBR) Clearance Guidance for Platforms and Materiel.

4. Additional Sustainment Considerations

a. Operations slow as tasks are performed by personnel encumbered by protective equipment or exposed to CBRN hazard effects. Contaminated equipment and supplies may require abandonment or limited use. Transfer of missions to uncontaminated forces or avoidance of planned terrain and routes may be required to reduce compounding effects from exposure. Additionally, CBRN use or contamination resulting in a major disruption of normal personnel and materiel replacement processes in the theater could severely hamper the component commanders’ capabilities for force generation and sustainment.

(1) Theater sustainment capabilities should be protected. CBRN contamination at an essential port of embarkation or port of debarkation or other critical logistic facility can significantly affect execution. Measures to prevent and mitigate the effects of CBRN contamination focus on maintaining support to combat operations and rapidly restoring the degraded capabilities. Preventing and mitigating the effects of CBRN hazards on equipment and supplies include the use of protective coatings and coverings. Under some circumstances it may be necessary to use alternative facilities.

(2) Protecting forces from the effects of a CBRN environment is logistically taxing. Resupply requirements for protective clothing, medical supplies (e.g., antidotes, antibiotics, antivirals), and sustainment supplies for quarantine/isolation facilities are time-sensitive. Limited availability CBRN protective equipment may require movement within the theater. Personnel and equipment decontamination requires a great amount of water, which becomes contaminated in the process. These and other resources needed for recovery from CBRN incidents can severely strain the theater logistic system and have unanticipated effects on combat operations.

(3) **Logistic Planning Considerations for Fixed Sites.** Ports, airfields, terrestrial space facilities, intelligence operations facilities, and related fixed sites are choke points vulnerable to CBRN incidents and potentially high-value targets. Combat forces are vulnerable to CBRN incidents during entry operations and during movement to areas of military operations. Common fixed-site defense measures can reduce their vulnerability.

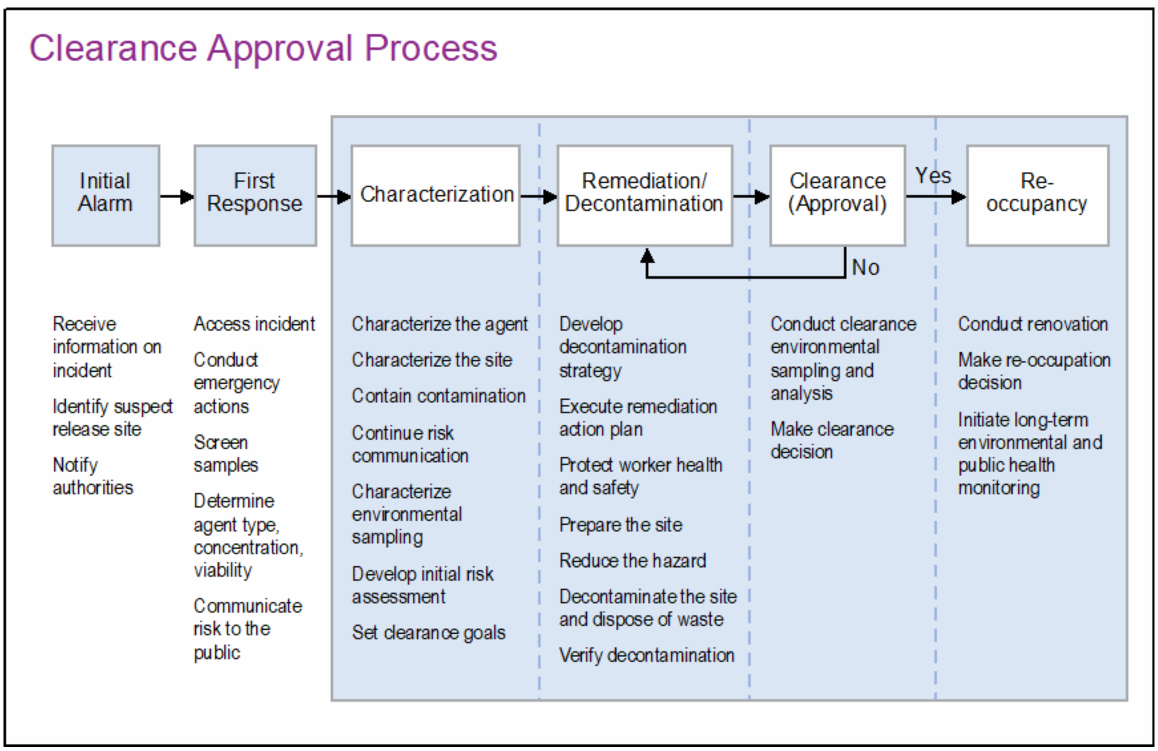

Figure F-4. Clearance Approval Process

(a) **Considerations for APODs.** While each APOD is unique, a few general considerations are important. When considering CBRN threats, the installation's overall size, with respect to the mission and its operational capacity and flexibility, affects the commander's options for decontamination and avoidance. However, conducting successful attacks against APODs presents significant challenges to the adversary. If installation leadership and personnel are properly prepared to survive the attack and sustain operations, CBRN attacks may not cause significant long-term degradation of throughput capacity. Attacks that could cause significant degradation to throughput capacity include nuclear attacks, persistent chemical agents causing a long-term vapor hazard requiring continued MOPP level 4, or a biological agent attack that remains undetected until it has spread through a significant portion of critical personnel or equipment. This is especially true at large APODs where critical assets and much of the storage areas and materials handling equipment could easily escape contamination. Operations in these cases may be limited more by the effects of the attacks on the local work force and nearby civilian population. In most cases, it is possible to continue operations at a contaminated APOD. While CBRN incidents may result in contamination of some operating surfaces, the size of the hazard area may be small compared to the size of the installation. The capability to quickly shift operations to those areas and facilities on the installation that were not contaminated is key to sustaining throughput operations.

1. If necessary, contaminated aircraft are decontaminated to the level required by DoD and the HN, and acceptable to the International Civil Aviation Organization, before returning to the air mobility flow. The CCDR is responsible for establishing control of contaminated aircraft in the AOR and at designated decontamination sites, as well as for procedures to address overflight requirements and destination base/country landing rights for previously contaminated aircraft.

2. In CBRN environments, there are limitations on the employment of aircraft. Some aircraft are not able to land at or depart from contaminated areas regardless of an aerial port's CBRN preparedness. Of particular importance are the Civil Reserve Air Fleet and civilian aircraft under contract. CCMD plans should provide for replacing these aircraft with other airlift assets or conducting transload operations from bases outside the immediate threat area. These replacement aircraft would have to operate from transload airbases to shuttle the affected cargo and passengers to the theater. If that is not feasible, alternative means (e.g., sea, rail, or wheeled transport) should be made available.

3. The availability of alternative aerial ports to accomplish the transload of personnel and materiel from intertheater to intratheater airlift can minimize potential deployment interruptions by adversary CBRN use. The supported CCDR, in coordination with Commander, USTRANSCOM, is responsible for designating transload aerial ports. All means of active and passive contamination avoidance measures are used to minimize the level of contamination and prevent further cross-contamination during operations.

(b) **Considerations for Seaports of Embarkation.** JFC plans should take into account Military Sealift Command ships exposed to contamination. Contaminated

RECONSTITUTION FOLLOWING OPERATION TOMODACHI

In 2011 a major earthquake struck off the northern coast of Japan resulting in a massive tsunami that crippled the Fukushima Daiichi Nuclear Power Station. The Department of Defense, along with several United States Government departments and agencies, executed a response plan to support the government of Japan. This response, known as Operation TOMODACHI, included over 20 ships, more than 100 aircraft, and a total of over 20,000 personnel. United States Navy and Air Force forces were staged well outside high radiation areas as a safeguard against prolonged exposure and contamination to equipment. However, the incident plumes carried contamination to high altitudes and miles offshore.

Following the operation, all equipment underwent detailed clearance inspection prior to resuming normal operations. The clearance threshold for equipment slated to redeploy outside of Japan was stricter than for equipment slated to remain in Japan. The strict clearance criteria for equipment leaving Japan was because out-of-area personnel operating in and around the platforms did not have the same level of radiological monitoring as personnel in Japan.

Decontamination efforts to meet clearance level thresholds required hundreds of personnel-hours for some aircraft. Additionally, each compartment on each ship required a detailed inspection, resulting in hundreds of personnel-hours. Compartments not meeting clearance thresholds required additional personnel-hours to perform mitigation techniques such as sanding, scraping, and repainting or replacing items. Five years after Operation TOMODACHI, sixteen ships had measurable residual radiation. While these ships remained below thresholds posing a danger to personnel, many challenges and concerns related to reconstitution efforts followed operations in the contaminated environment.

Various Sources

ships require decontamination support and certification acceptable to civil authorities to load additional cargo at uncontaminated US or foreign commercial port facilities.

(c) **Considerations for SPODs.** In large-scale operations, US equipment and materiel normally enter the theater on sealift ships and offload at SPODs. The importance of these seaports to the United States makes them an attractive target for CBRN attack. However, conducting successful attacks against SPODs presents significant challenges to the adversary. If port managers and operators are properly prepared to survive the attack and sustain operations, CBRN attacks may not cause significant long-term degradation of military logistic capacity. This is especially true at large ports where many piers, storage areas, and much of the materials handling equipment may escape contamination. Operations in these cases may be limited more by the effects of the attacks on the local work force and nearby civilian populations.

1. Though similarities concerning the impact of CBRN attack on SPOD and APOD operations exist, there are differences.

2. Each port provides unique capabilities and has different vulnerabilities in CBRN environments, but contamination avoidance is an essential element of sustaining operations. In normal circumstances, a port is but one node of a complex, theater-wide logistic network. Plans should include options for redirecting incoming ships from contaminated ports to those that are uncontaminated or using joint logistics over-the-shore operations, if feasible. However, when alternative ports with adequate capacity and berths to handle large cargo ships are not available, it may be necessary to continue operations at contaminated ports. In considering alternative ports, planners take into account the requirements for unit equipment to arrive in proximity to the marshalling areas for unit personnel, ammunition, and sustainment supplies to ensure coherent reception, staging, onward movement, and integration for affected units.

3. In some cases, it is possible to continue operations at a contaminated port. While CBRN incidents may result in contamination of some operating surfaces, the size of the contaminated area may be small compared to the size of the port. The capability to shift operations to those areas and facilities within the port that escaped contamination is key to sustaining throughput operations. Proper preparation can significantly reduce the impact of CBRN incidents on a SPOD.

b. Specific sustaining considerations include:

(1) Decontaminating critical areas or facilities.

(2) Determining the disposition of contaminated equipment, facilities, and human remains.

(3) Coordinating salvage and decontamination of materials.

(4) Providing C2 of restoration operations.

(5) Integrating CBRN incident restoration operations.

(6) Providing restoration country assistance teams.

(7) Establishing reporting procedures for restoration requirements.

(8) Providing operational guidance to contaminated forces.

(9) Assessing the operational impact of restoration activities, including assessing the linkage of restoration and the operational risk assessment.

(10) Supporting restoration of special operations.

(11) Establishing contamination control.

(12) Working with HN.

(a) Supplying or pre-positioning protective consumable, expendable, and replacement CBRN equipment.

(b) Employing protective measures to minimize the effects of CBRN incidents.

(c) Integrating multinational and US protective measures and assets.

(d) Establishing appropriate CBRN medical protection measures.

(e) Providing COLPRO for C2, medical operations, and workforce rest and relief.

(f) Implementing effective ROM, including social distancing, isolation, and quarantine as appropriate, to limit exposure following a CBRN incident.

(g) Coordinating the disposal of contaminated wastewater storage, removal and transport, and disposition from decontamination operations in accordance with HN guidelines.

(h) Identifying HN decontamination capabilities.

(i) Establishing contaminated patient treatment capability and capacity.

(j) Establishing contamination containment and clean up support.

(k) Providing support in communications and assistance with security, crowd control, and traffic regulating.

(l) Monitoring of wind/weather patterns.

(m) Establishing medical treatment facilities that accept patients with potential exposure to CBRN hazard.

(n) Providing en route care capabilities.

(o) Providing patient evacuation support.

APPENDIX G
TECHNICAL CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR FORCES

1. This appendix introduces technical CBRN force capabilities and some planning considerations for their use during operations in support of operational- and strategic-level objectives where CBRN hazards exist.

2. It is imperative the JFC and those responsible for apportioning forces and developing support plans not only understand the unique capabilities but also the limitations of technical CBRN forces within their operational areas prior to a CBRN incident or CWMD mission.

3. Technical CBRN forces include specialized capabilities and are organized, equipped, and trained to conduct CBRN operations beyond the tactical level and in support of operational and strategic objectives to counter WMD. Technical CBRN forces are generally scarce assets requiring significant mission prioritization to meet the commander's requirements. They possess advanced capabilities to identify CBRN threats and hazards with a high degree of confidence, providing evidence collection for attribution and the employment of medical countermeasures. Technical CBRN forces operate across the competition continuum and are able to integrate with joint, interagency, and multinational partners. Below is a list of DoD's technical CBRN forces and the references for additional information on them:

a. CBRN companies, platoons, and teams that conduct reconnaissance, surveillance, and decontamination.

b. Chemical, biological, radiological, nuclear, and explosive response teams.

c. Chemical-Biological Incident Response Force.

For more information on these units, see ATP 3-11.36/MCRP 10-10E.1/NTTP 3-11.34/AFTTP 3-2.70, Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Planning.

d. WMD coordination teams (for more information, see ATP 3-37.11, *Chemical, Biological, Radiological, Nuclear, and Explosives Command*).

e. Nuclear disablement teams (for more information, see ATP 3-37.11).

f. DoD Chemical, Biological, Radiological, and Nuclear Response Enterprise forces (for more information, see ATP 3-11.42/MCRP 10-10E.10/NTTP 3-11.38, *Multi-Service Tactics, Techniques, and Procedures for Domestic Chemical, Biological, Radiological, and Nuclear Response*).

g. CBRNE analytical and remediation activity (for more information, see ATP 3-37.11).

h. Laboratory support (for more information, see ATP 3-37.11, as well as ATP 3-11.37/MCRP 10-10E.7/NTTP 3-11.29/AFTTP 3-2.44, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance*).

i. United States Air Force CBRN/emergency management hazard assessment team and installation management team for military operations in a CBRN, major accident response, or natural disaster environment. (For more information, see Department of the Air Force Manual 10-2503, *Operations in a Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive [CBRNE] Environment*, and ATP 3-11.36/MCRP 10-10E.1/NTTP 3-11.34/AFTTP 3-2.70.)

j. United States Air Force CBRN/emergency management superintendent and air operations center manager for operations at the installation, warfighting headquarters, combined/joint task force, or major command level (for more information, see Department of the Air Force Manual 10-2503 and ATP 3-11.36/MCRP 10-10E.1/NTTP 3-11.34/AFTTP 3-2.70).

k. United States Air Force Radiation Assessment Team provides rapid, global response to radiation/nuclear accidents and incidents. They provide expertise in planning, surveillance, analysis, and assessment of health, environmental, and operational risks and advise commanders and other decision makers on radiation health effects, operational impacts, protective actions, recovery activities, environmental health risks, and risk management during contingency planning, response, and post-contingency operations (for more information, see ATP 3-11.36/MCRP 10-10E.1/NTTP 3-11.34/AFTTP 3-2.70, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Planning*).

l. United States Army Nuclear and Countering Weapons of Mass Destruction Agency nuclear employment augmentation teams and CWMD planning assistance teams. For more information, see Army Regulation 10-16, *US Army Nuclear and Countering Weapons of Mass Destruction Agency.*

4. The United States Marine Corps provides a naval force uniquely capable of transitioning ready-to-fight combat forces from sea to shore to achieve CWMD objectives. The Marine air-ground task force provides the JFC with adaptive technical force packages capable of dismounted CBRN reconnaissance, CBRN support to sensitive site exploitation, contamination control, and operational and technical decontamination. The scalability of the Marine air-ground task force makes Marine Corps forces suitable to integrate with SOF and naval forces conducting CWMD activities. Marine Corps Tactical Publication 10-10E, *MAGTF Nuclear, Biological, and Chemical Defense Operations,* provides additional capability and limitation information.

5. DoD allocates forces for the homeland CBRN response mission. These forces are collectively referred to as the CBRN Response Enterprise and comprise both National Guard and federal forces. Under state control, these National Guard forces consist of WMD-civil support teams, CBRN-enhanced response force packages, and homeland response forces. Under federal control, forces consist of the Defense CBRN Response Force with Joint Task Force-Civil Support as its C2 headquarters and two C2 CBRN response elements, for deployment to multiple CBRN incidents or to generate the required capacity for one catastrophic event. United States Coast Guard (USCG) forces retain CBRN capabilities that can contribute to homeland defense and homeland security response, but is not part of the DoD's CBRN Response Enterprise.

6. Although SOF train for operations in CBRN environments, they cannot fully operate under CBRN threat conditions without the assistance of conventional forces. For example, while SOF have organic CBRN decontamination, reconnaissance, and sensitive site exploitation capability, they lack the capacity to conduct long-term sustainment and reconstitution operations without large-scale logistical resupply.

For more detailed information on SOF capabilities and limitations, see JP 3-05, Joint Doctrine for Special Operations.

7. DTRA provides the following support either on-site or via reachback:

a. Reachback support teams offer both residential and mobile training team opportunities for users to train on and receive modeling and simulation software.

b. CBRN technical and scientific SMEs, planners, and hazard prediction modeling support to JFCs and mission partners or their delegated representatives in response to catastrophic incidents involving WMD in the United States and abroad, when requested.

c. Planning teams assist JFCs or other mission partners with CWMD planning and analysis.

d. Forward-deployment CBRN SMEs and teams augment existing DTRA capabilities at supported organizations.

e. A joint mission assurance assessment team conducts risk-based assessments of an installation's ability to mitigate threats from all hazards and threats.

f. DTRA technical support groups train, advise, equip, assist, and employ CWMD support to CCDRs and, upon SecDef approval, to other USG departments and agencies.

g. Additionally, DTRA is the single-source point of contact for technical reachback requests for information via its National Countering Weapons of Mass Destruction Technical Reachback Enterprise, a CWMD support element that provides time-sensitive access to a broad range of CBRN SMEs in a collaborative environment supporting modeling and simulation and technical analysis for planning, execution/response, and assessment. Requests for DTRA WMD and CBRN national reachback support are made via the DTRA Joint Operations Center (continuously manned). Phone: 1-877-240-1187 or 703-767-2000 or 703-767-2003 or DSN: 427-2000, 427-2003, 427-2116. E-mail: dtra-joc@mail.mil/dtra-joc@mail.smil.mil. Website: https://opscenter.dtra.mil (use CAC log-in with e-mail certificate); tech help at DSN 427-2116.

8. USCG forces conduct operations under USCG authorities or under DoD C2 when allocated to CCDRs. Captains of the port command the immediate response to CBRN incidents in the domestic maritime environment. As DoD and interagency resources and capabilities respond, USCG captains of the port play key roles in the C2 structure with their documented authorities and responsibilities. Most USCG general purpose forces have limited CBRN capabilities to conduct initial response operations in contaminated environments. Select USCG deployable specialized forces with advanced CBRN technical capabilities may deploy to support countering WMD proliferation efforts by CCDRs with AORs. These specialized forces include maritime security response teams and the National Strike Force. The maritime security response teams may operate in an opposed environment, while National Strike Force elements operate in a permissive environment. In addition, National Strike Force may serve as, or support, the designated federal on-scene coordinator for a hazardous material incident. USG national security cutters can detect and monitor CBRN contamination and the crew is equipped with PPE.

9. **Explosive Ordnance Disposal (EOD).** Joint EOD forces enable access to areas denied by explosive and CBRN hazards. EOD forces operate across the joint force during domestic CBRN response and ICBRN-R. All EOD forces are trained to provide initial response to a WMD incident. Certain elements within the EOD force are able to provide specific capabilities to render-safe. EOD forces are critical components of handling and exploitation of captured or discovered enemy CBRN munitions and devices, FP measures, and defense of critical infrastructure.

For more information on EOD forces and roles, see JP 3-42, Joint Explosive Ordnance Disposal.

APPENDIX H
REFERENCES

The development of JP 3-11 is based upon the following primary references:

1. General

a. Homeland Security Presidential Directive-18, *Medical Countermeasures Against Weapons of Mass Destruction.*

b. Homeland Security Presidential Directive-22, *(U) Domestic Chemical Defense.*

c. National Security Presidential Memorandum-14, *(U) National Security Memorandum on Support for National Biodefense.*

d. National Security Presidential Directive-46/Homeland Security Presidential Directive-15, *(U) US Policy and Strategy in the War on Terror[ism]*.

e. Presidential Policy Directive-8, *National Preparedness.*

f. National Security Presidential Memorandum-36, *(U) Guidelines for US Government Interagency Response to Terrorist Threats or Incidents in the US and Overseas.*

g. Presidential Policy Directive-42, *(U) Preventing and Countering Weapons of Mass Destruction Proliferation, Terrorism, and Use.*

h. *National Security Strategy, October 2022.*

i. *(U) 2022 National Defense Strategy of the United States of America*.

j. *(U) National Military Strategy of the United States of America 2022.*

k. *National Response Framework,* Fourth Edition.

l. *National Biodefense Strategy and Implementation Plan.*

m. *National Strategy for Biosurveillance.*

n. *National Strategy for Countering Biological Threats.*

o. *National Strategy for Homeland Security*.

p. *Strategy for Homeland Defense and Defense Support of Civil Authorities.*

q. *Department of Defense Strategy for Countering Weapons of Mass Destruction.*

r. Memorandum from the Under Secretary of Defense for Policy, Subject: *Radiological Clearance Criteria Guideline for Platforms and Materiel,* Change 1, 2012.

s. Memorandum from the Under Secretary of Defense, Subject: *Chemical Clearance Guideline for Platforms and Materiel*, 26 August 2014.

t. Memorandum from the Under Secretary of Defense, Subject: *Biological Clearance Guideline for Platforms and Materiel,* 27 September 2020.

u. *2020 Emergency Response Guidebook.*

v. *Fourth Generation Agents: Reference Guide*, January 2019.

2. Department of Defense Publications

a. DoDD 3025.18, *Defense Support of Civil Authorities (DSCA).*

b. DoDD 3150.08, *DoD Response to US Nuclear Weapon and Radiological Material Incidents.*

c. DoDD 5100.46, *Foreign Disaster Relief (FDR).*

d. DoDD 5210.56, *Arming and the Use of Force*.

e. DoDD 5240.01, *DoD Intelligence Activities.*

f. DoDD 6400.04E, *DoD Veterinary Public and Animal Health Services.*

g. DoDD 6420.02, *DoD Biosurveillance*.

h. DoDD 6490.02E, *Comprehensive Health Surveillance.*

i. DoDI 2000.12, *DoD Antiterrorism (AT) Program.*

j. DoDI 2000.21, *DoD Support to International Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents.*

k. DoDI 3020.52, *DoD Installation Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive (CBRNE) Preparedness Standards.*

l. DoDI 6055.01, *DoD Safety and Occupational Health (SOH) Program.*

m. DoDI 6055.08, *Occupational Ionizing Radiation Protection Program.*

n. DoDI 6055.17, *DoD Emergency Management (EM) Program.*

o. DoDI 6200.03, *Public Health Emergency Management (PHEM) Within the DoD.*

p. DoDI 6440.03, *DoD Laboratory Network (DLN).*

q. DoDI 6490.03, *Deployment Health.*

r. Department of Defense Manual 3145.03, *DoD Chemical, Biological, and Radiological (CBR) Clearance Guidance for Platforms and Materiel.*

s. *Department of Defense Foreign Clearance Manual* (https://www.fcg.pentagon.mil).

3. Chairman of the Joint Chiefs of Staff Publications

a. CJCS Concept Plan 0500, *Military Assistance to Domestic Consequence Management Operations in Response to a Chemical, Biological, Radiological, Nuclear, or High-Yield Explosives Situation.*

b. CJCSI 2030.01E, *Chemical Weapons Convention Implementation and Compliance Policy Guidance.*

c. CJCSI 2700.01H, *Rationalization, Standardization, and Interoperability (RSI) Activities.*

d. CJCSI 3121.01B, *(U) Standing Rules of Engagement/Standing Rules for the Use of Force for US Forces.*

e. CJCSI 3125.01D, *Defense Response to Chemical, Biological, Radiological, and Nuclear (CBRN) Incidents in the Homeland.*

f. CJCSI 3214.01E, *Defense Support for Chemical, Biological, Radiological, and Nuclear Incidents on Foreign Territory.*

g. CJCSI 3222.01C, *Chairman of The Joint Chiefs of Staff Requirements for Electromagnetic Pulse Protection of Critical Nodes and Systems*.

h. CJCSI 3431.01F, *Joint Nuclear Accident Incident Response Team.*

i. CJCS Manual 3122.01A, *Joint Operation Planning and Execution System (JOPES) Volume I, Planning Policies and Procedures.*

j. CJCS Manual 3130.03A, *Planning and Execution Formats and Guidance.*

k. JP 1, Volume 1, *Joint Warfighting*.

l. JP 1-0, *Joint Personnel Support.*

m. JP 2-0, *Joint Intelligence.*

n. JP 3-0, *Joint Campaigns and Operations.*

o. JP 3-04, *Information in Joint Operations.*

p. JP 3-05, *Joint Doctrine for Special Operations.*

q. JP 3-06, *Joint Urban Operations.*

r. JP 3-08, *Interorganizational Cooperation.*

s. JP 3-10, *Joint Security Operations in Theater*.

t. JP 3-20, *Security Cooperation*.

u. JP 3-27, *Joint Homeland Defense.*

v. JP 3-28, *Defense Support of Civil Authorities.*

w. JP 3-29, *Foreign Humanitarian Assistance.*

x. JP 3-33, *Joint Force Headquarters.*

y. JP 3-35, *Joint Deployment and Redeployment Operations.*

z. JP 3-40, *Joint Countering Weapons of Mass Destruction.*

aa. JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response.*

bb. JP 3-42, *Joint Explosive Ordnance Disposal*.

cc. JP 3-61, *Public Affairs.*

dd. JP 3-85, *Joint Electromagnetic Spectrum Operations*.

ee. JP 4-0, *Joint Logistics*.

ff. JP 4-02, *Joint Health Services.*

gg. JP 5-0, *Joint Planning*.

hh. JP 6-0, *Joint Communications System.*

ii. *Joint Guide for Joint Intelligence Preparation of the Operational Environment.*

4. Multi-Service Publications

a. ATP 3-11.32/MCRP 10-10E.11/NTTP 3-11.27/AFTTP 3-2.46, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Protection.*

b. ATP 3-11.33/MCRP 10-10E.12/NTTP 3-11.26/AFTTP 3-2.60, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Mitigation.*

c. ATP 3-11.36/MCRP 10-10E.1/NTTP 3-11.34/AFTTP 3-2.70, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Planning.*

d. ATP 3-11.37/MCRP 10-10E.7/NTTP 3-11.29/AFTTP 3-2.44, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance.*

e. ATP 3-11.42/MCRP 10-10E.10/NTTP 3-11.38, *Multi-Service Tactics, Techniques, and Procedures for Domestic Chemical, Biological, Radiological, and Nuclear Response.*

f. ATP 3-11.46/AFTTP 3-2.81, *Weapons of Mass Destruction-Civil Support Team Operations.*

g. ATP 3-11.47/AFTTP 3-2.79, *Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Enhanced Response Force Package (CERFP)/Homeland Response Force (HRF) Operations.*

h. ATP 3-72/MCRP 10-10E.9/NTTP 3-72.1/AFTTP 3-2.65, (*U) Operations in a Nuclear Environment.*

i. ATP 4-02.7/MCRP 3-40A.6/NTTP 4-02.7/AFTTP 3-42.3, *Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment.*

j. ATP 4-02.83/MCRP 3-40A.2/NTRP 4-02.21/Air Force Manual 44-161(I), *Multi-Service Tactics, Techniques, and Procedures for Treatment of Nuclear and Radiological Casualties.*

k. ATP 4-02.84/MCRP 3-40A.3/NTRP 4-02.23/Air Force Manual 44-156 IP, *Multi-Service Tactics, Techniques, and Procedures for Treatment of Biological Warfare Agent Casualties.*

l. ATP 4-02.85/MCRP 3-40A.1/NTRP 4-02.22/AFTTP(Instruction) 3-2.69, *Multi-Service Tactics, Techniques, and Procedures for Treatment of Chemical Warfare Agent Casualties and Conventional Military Chemical Injuries.*

m. ATP 4-32.2/MCRP 10-10D.1/NTTP 3-02.4.1/AFTTP 3-2.12, *Multi-Service Tactics, Techniques, and Procedures for Explosive Ordnance.*

n. ATP 4-46/MCRP 3-40G.3/NTTP 4-06/AFTTP 3-2.51, *Multi-Service Tactics, Techniques, and Procedures for Mortuary Affairs in Theaters of Operations.*

o. NTTP/Coast Guard TTP 3-20.31, *Surface Ship Survivability*.

p. TM 3-11.91/MCRP 10-10E.4/NTRP 3-11.32/AFTTP 3-2.55, *Chemical, Biological, Radiological, and Nuclear Threats and Hazards.*

q. TM 3-11.91/MCRP 10-10E.4/NTRP 3-11.32/AFTTP 3-2.55, *(U) Chemical, Biological, Radiological, and Nuclear Threats and Hazards.*

5. United States Marine Corps Publications

a. Marine Corps Doctrinal Publication 10-10E.9, *(U) Operations in a Nuclear Environment.*

b. MCRP 10-10E.8 w/CH1, *CBRN Passive Defense.*

c. Marine Corps Tactical Publication 10-10E, *MAGTF Nuclear, Biological, and Chemical Defense Operations.*

6. United States Navy Publication

Naval Ships' Technical Manual Chapter 470, Shipboard Chemical Warfare/Biological Warfare (CW/BW) Defense and Countermeasures.

7. United States Army Publications

a. ATP 3-05.11, *Special Operations Chemical, Biological, Radiological, and Nuclear Operations.*

b. ATP 3-37.11, *Chemical, Biological, Radiological, Nuclear, and Explosives Command.*

c. ATP 4-32, *Explosive Ordnance Disposal (EOD) Operations.*

d. Field Manual 3-11, *Chemical, Biological, Radiological, and Nuclear Operations.*

8. United States Air Force Publications

a. Air Force Policy Directive 10-25, *Air Force Emergency Management Program*.

b. Air Force Policy Directive 10-26, *Countering Weapons of Mass Destruction Enterprise.*

c. Air Force Doctrine Publication 3-40, *Counter-Weapons of Mass Destruction Operations.*

d. Department of the Air Force Instruction 10-2501, *Emergency Management Program*.

e. Air Force Instruction 10-2519, *Public Health Emergencies and Incidents of Public Health Concern.*

f. Air Force Instruction 10-2607, *Chemical, Biological, Radiological, and Nuclear Survivability*.

g. Department of the Air Force Instruction 34-160, *Mortuary Affairs Program.*

h. Air Force Manual 48-148, *Ionizing Radiation Protection.*

i. Department of the Air Force Manual 10-2503, *Operations in a Chemical, Biological, Radiological, and Nuclear (CBRN)Environment.*

9. United States Coast Guard Publications

a. Commandant Instruction 3400.5, *Policy for Countering Weapons of Mass Destruction.*

b. Commandant Instruction M3400.51, *United States Coast Guard Countering Weapons of Mass Destruction Capabilities Manual.*

c. Coast Guard Publication 3-1, *Deployable Specialized Forces.*

10. Multinational Publications

a. Allied Joint Publication 3-8, *Allied Joint Doctrine for Comprehensive Chemical, Biological, Radiological, and Nuclear Defence.*

b. NATO Allied Medical Publication-6(C) Volume 1, *NATO Handbook on the Medical Aspects of NBC Defensive Operations (Nuclear).*

c. NATO Allied Medical Publication-6(C) Volume 2, *NATO Handbook on the Medical Aspects of NBC Defensive Operations (Biological).*

d. NATO Allied Medical Publication-6(C) Volume 3, *NATO Handbook on the Medical Aspects of NBC Defensive Operations (Chemical).*

e. Allied Engineering Publication-7, *Chemical, Biological, Radiological, and Nuclear (CBRN) Defense Factors in the Design, Testing, and Acceptance of Military Equipment* (Edition 5).

f. NATO Standardization Agreement 2471 Edition 4, *Chemical, Biological, Radiological, and Nuclear (CBRN) Hazard Management for Airlift Operations.*

g. NATO Standardization Agreement 2473, *Commander's Guide to Radiation Exposures in Non-Article 5 Crisis Response Operations.*

APPENDIX J
ADMINISTRATIVE INSTRUCTIONS

1. User Comments

Users in the field are highly encouraged to submit comments on this publication using the Joint Doctrine Feedback Form located at https://jdeis.js.mil/jdeis/jel/jp_feedback_form.pdf and e-mail it to js.pentagon.j7.mbx.jedd-support@mail.mil. These comments should address content (accuracy, usefulness, consistency, and organization), writing, and appearance.

2. Authorship

The lead agent for this publication is the US Army. The Joint Staff doctrine sponsor for this publication is the Director, Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense (J-8). The technical review authority is the Defense Threat Reduction Agency.

3. Supersession

This publication supersedes JP 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments,* 29 October 2018.

4. Change Recommendations

a. To provide recommendations for urgent and/or routine changes to this publication, please complete the Joint Doctrine Feedback Form located at https://jdeis.js.mil/jdeis/jel/jp_feedback_form.pdf and e-mail it to js.pentagon.j7.mbx.jedd-support@mail.mil.

b. When a Joint Staff directorate submits a proposal to the CJCS that would change source document information reflected in this publication, that directorate includes a proposed change to this publication as an enclosure to its proposal. The Services and other organizations are requested to notify the Joint Staff J-7 when changes to source documents reflected in this publication are initiated.

5. Lessons Learned

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(2) SIPRNET JEL+ at https://jdeis.js.smil.mil/jdeis/index.jsp.

GLOSSARY
PART I—SHORTENED WORD FORMS (ABBREVIATIONS, ACRONYMS, AND INITIALISMS)

AFTTP	Air Force tactics, techniques, and procedures
ALARA	as low as reasonably achievable
AOR	area of responsibility
APOD	aerial port of debarkation
ATP	Army techniques publication
C2	command and control
CBRN	chemical, biological, radiological, or nuclear
CBRNE	chemical, biological, radiological, nuclear, and high-yield explosives (USA/NGB/USCG)
CBRNWRS	chemical, biological, radiological, and nuclear warning and reporting system
CCDR	combatant commander
CCMD	combatant command
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff instruction
COA	course of action
COLPRO	collective protection
CWMD	countering weapons of mass destruction
DoD	Department of Defense
DoDD	Department of Defense directive
DoDI	Department of Defense instruction
DTRA	Defense Threat Reduction Agency
EMP	electromagnetic pulse
EOD	explosive ordnance disposal
FGA	fourth generation agent
FP	force protection
HN	host nation
ICBRN-R	international chemical, biological, radiological, and nuclear response
IED	improvised explosive device
IEW	integrated early warning
IPE	individual protective equipment
ISR	intelligence, surveillance, and reconnaissance

JFC	joint force commander
JIPOE	joint intelligence preparation of the operational environment
JP	joint publication
MCRP	Marine Corps reference publication
MOPP	mission-oriented protective posture
NATO	North Atlantic Treaty Organization
NTA	nontraditional agent
NTRP	Navy tactical reference publication
NTTP	Navy tactics, techniques, and procedures
OE	operational environment
OEG	operational exposure guidance
OPTEMPO	operating tempo
PPE	personal protective equipment
RDD	radiological dispersal device
RES	radiation exposure status
ROM	restriction of movement
SecDef	Secretary of Defense
SME	subject matter expert
SOF	special operations forces
SPOD	seaport of debarkation
TIB	toxic industrial biological
TIC	toxic industrial chemical
TIM	toxic industrial material
TM	technical manual
TTP	tactics, techniques, and procedures
US	United States
USCG	United States Coast Guard
USG	United States Government
USTRANSCOM	United States Transportation Command
WMD	weapons of mass destruction

PART II—TERMS AND DEFINITIONS

1. JP 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments,* 29 September 2024, Active Terms and Definitions

acute radiation dose. A dose of ionizing radiation of sufficient strength to cause irreversible damage. (Approved for incorporation into the DoD Dictionary.)

acute radiation syndrome. An acute illness caused by irradiation of the body by a high dose of penetrating radiation in a very short period of time. (DoD Dictionary. Source: JP 3-11)

biological agent. A microorganism, including viruses, or toxin that causes illness, injury, damage, or death. (Approved for incorporation into the DoD Dictionary.)

blister agent. A chemical agent that injures the eyes and lungs, and burns or blisters the skin. Also called **vesicant agent.** (DoD Dictionary. Source: JP 3-11)

chemical agent. A chemical substance intended for use in military operations to kill, injure, or incapacitate through its physiological effects. (Approved for incorporation into the DoD Dictionary.)

chemical, biological, radiological, or nuclear defense. Actions taken to counter chemical, biological, radiological, or nuclear hazards; reduce their risks; and prepare for, respond to, and recover from chemical, biological, radiological, or nuclear incidents. Also called **CBRN defense.** (Approved for replacement of "chemical, biological, radiological, and nuclear defense" and its definition in the DoD Dictionary.)

chemical, biological, radiological, or nuclear environment. An operational environment that includes probable chemical, biological, radiological, or nuclear threats and hazards and their resulting effects. Also called **CBRN environment.** (Approved for replacement of "chemical, biological, radiological, and nuclear environment" and its definition in the DoD Dictionary.)

chemical, biological, radiological, or nuclear hazard. Chemical, biological, radiological, or nuclear elements that pose a threat to humans, animals, plants, or the environment. Also called **CBRN hazard.** (Approved for replacement of "chemical, biological, radiological, and nuclear hazard" and its definition in the DoD Dictionary.)

chemical, biological, radiological, or nuclear incident. Any accidental or intentional release of a chemical, biological, radiological, or nuclear hazard. (Approved for incorporation into the DoD Dictionary.)

chemical hazard. Any chemical manufactured, used, transported, or stored that can cause death or other harm through toxic properties of those materials, including chemical agents, chemical weapons prohibited under the Chemical Weapons Convention, and toxic industrial chemicals. (Approved for incorporation into the DoD Dictionary.)

chemical weapon. A munition or device designed to cause death or harm through chemical agents. (Approved for incorporation into the DoD Dictionary.)

clearance decontamination. The final level of decontamination of equipment and personnel that allows unrestricted transportation, maintenance, employment, and disposal. (Approved for incorporation into the DoD Dictionary.)

collective protection. The protection provided to a group of individuals that permits relaxation of individual chemical, biological, radiological, or nuclear protection. Also called **COLPRO.** (Approved for incorporation into the DoD Dictionary.)

contamination avoidance. Individual or unit measures taken to reduce the effects of chemical, biological, radiological, and nuclear hazards. (Approved for incorporation into the DoD Dictionary.)

decontamination. The process of making any person, object, or area safe by destroying, neutralizing, making harmless, or absorbing and removing chemical or biological agents or by removing radioactive material clinging to or around it. (DoD Dictionary. Source: JP 3-11)

detection. In chemical, biological, radiological, and nuclear environments, the act of locating chemical, biological, radiological, and nuclear hazards. (Approved for incorporation into the DoD Dictionary.)

incapacitating agent. A chemical agent, which produces temporary disabling conditions that can be physical or mental and persist for hours or days after exposure to the agent has ceased. (DoD Dictionary. Source: JP 3-11)

individual protective equipment. The personal clothing and equipment provided to all military, government civilians, and contractors authorized to accompany the force required to protect an individual from chemical, biological, and radiological hazards and some nuclear hazards. Also called **IPE.** (DoD Dictionary. Source: JP 3-11)

ionizing radiation. Radiation of sufficient energy to displace electrons from atoms, producing ions. (Approved for incorporation into the DoD Dictionary.)

mission-oriented protective posture. A system of protection against chemical, biological, radiological, and nuclear contamination in which personnel are required to wear protective clothing and equipment appropriate to the threat level, work rate imposed by the mission or environment. Also called **MOPP.** (Approved for incorporation into the DoD Dictionary.)

nonpersistent agent. A chemical agent that, when released, dissipates or loses its ability to cause casualties rapidly, in a matter of minutes. (Approved for incorporation into the DoD Dictionary.)

operational exposure guidance. The maximum amount of ionizing radiation that the commander determines a unit may be permitted to receive while performing a mission. Also called **OEG.** (Approved for incorporation into the DoD Dictionary.)

persistent agent. A chemical agent that is able to cause casualties for hours or longer. (Approved for incorporation into the DoD Dictionary.)

personal protective equipment. Mission-specific protective equipment provided to shield or isolate personnel from hazards. Also called **PPE.** (Approved for incorporation into the DoD Dictionary.)

prompt radiation. Radiation emitted from the fireball of a nuclear burst within one minute after burst. (Approved for incorporation into the DoD Dictionary.)

radiation dose. The total amount of ionizing radiation absorbed by material or tissues. (DoD Dictionary. Source: JP 3-11)

radiation dose rate. Measurement of radiation dose per unit of time. (DoD Dictionary. Source: JP 3-11)

radiation exposure status. A risk management tool used to track unit exposure based on total cumulative dose, normally expressed in centigray. Also called **RES.** (Approved for incorporation into the DoD Dictionary.)

radiological dispersal device. An improvised assembly or process used to disseminate radioactive material to cause destruction, damage, or injury. Also called **RDD.** (Approved for incorporation into the DoD Dictionary.)

radiological exposure device. A radioactive source placed to cause injury or death. Also called **RED.** (DoD Dictionary. Source: JP 3-11)

residual radiation. Nuclear radiation caused by fallout, artificial dispersion of radioactive material, or irradiation that results from a nuclear explosion and persists longer than one minute after burst. (DoD Dictionary. Source: JP 3-11)

split-mission oriented protective posture. The use of different protective postures in different areas of the operational environment based on levels of contamination. Also called **split-MOPP.** (Approved for incorporation into the DoD Dictionary.)

thorough decontamination. The decontamination of personnel, equipment, materiel, or areas that permits the removal of individual protective equipment and enables operations to continue with minimum degradation. (Approved for incorporation into the DoD Dictionary.)

toxic industrial biological. Any biological material manufactured, used, transported, or stored by industrial, agricultural, medical, or commercial processes which could pose a hazard. Also called **TIB.** (Approved for incorporation into the DoD Dictionary.)

toxic industrial chemical. Any chemical developed, manufactured, used, transported, or stored by industrial, agricultural, medical, or commercial processes which could pose a hazard. Also called **TIC.** (Approved for incorporation into the DoD Dictionary.)

toxic industrial material. A generic term for toxic, chemical, biological, or radioactive substances that may be used, or stored for use, for industrial, agricultural, commercial, medical, military, or domestic purposes. Also called **TIM.** (Approved for incorporation into the DoD Dictionary.)

toxic industrial radiological. Any radiological material manufactured, used, transported, or stored by industrial, agricultural, medical, or commercial processes. Also called **TIR.** (Approved for incorporation into the DoD Dictionary.)

2. Terms Removed from the DoD Dictionary

- **Supersession of JP 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments,* 29 October 2018:** biological hazard; blood agent; chemical warfare; contamination; contamination control; contamination mitigation; half-life; immediate decontamination; mission-oriented protective posture gear; nerve agent; nuclear hazard; operational decontamination; overpressure; protective clothing; radiological hazard; riot control agent; shielding

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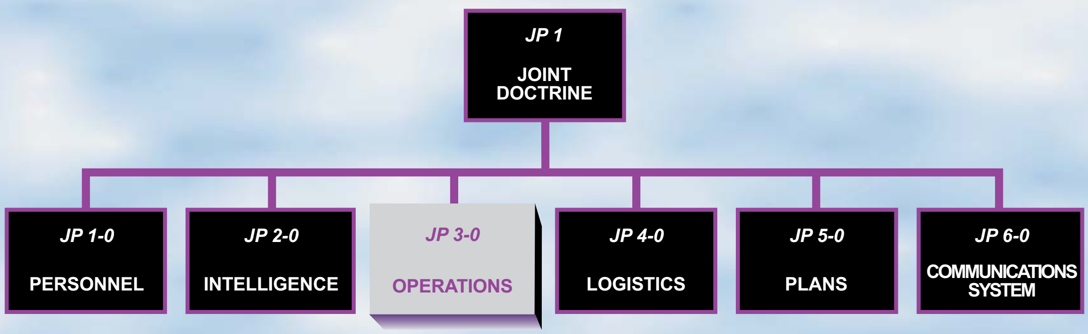

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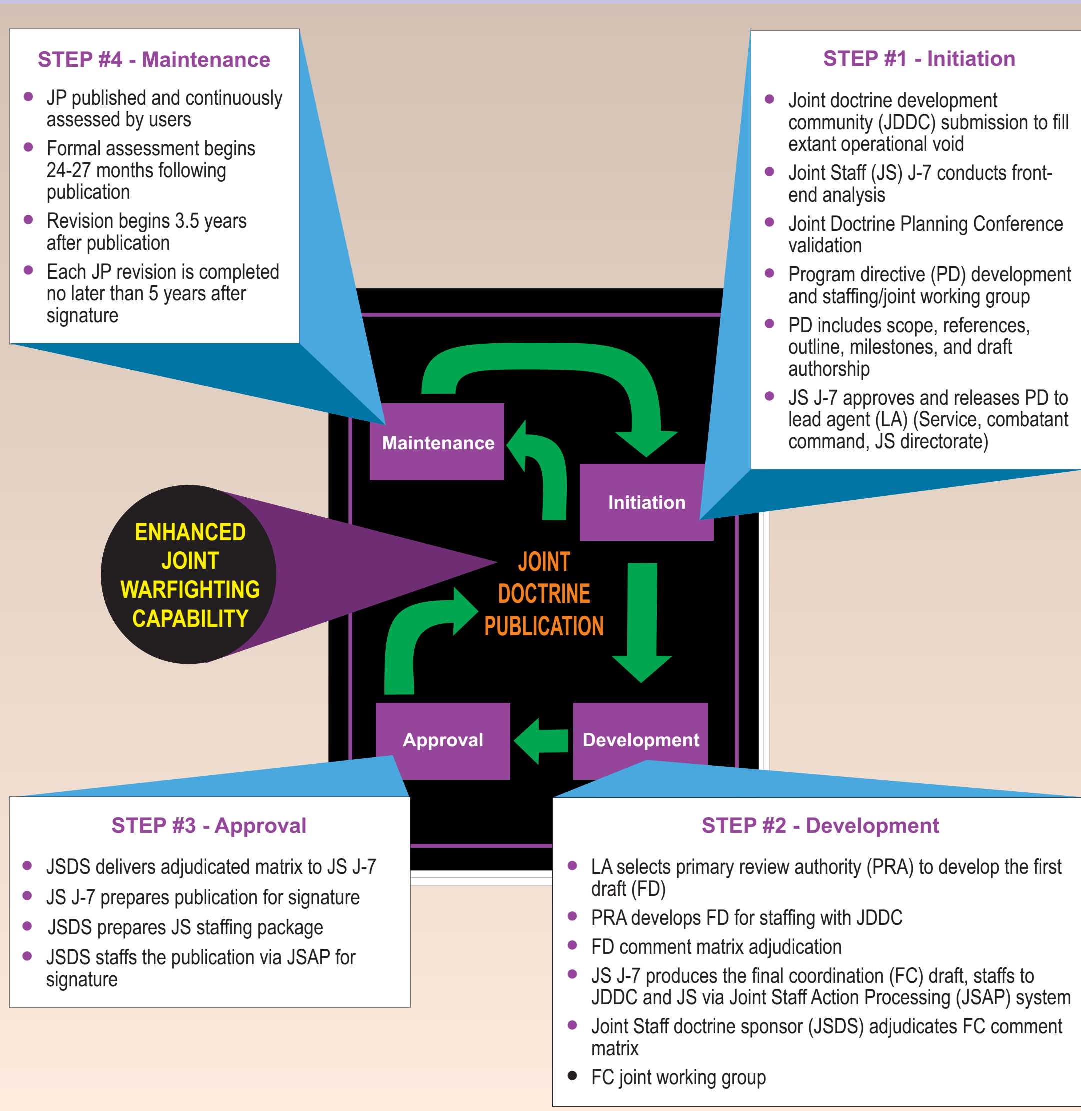

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